

**California Plumbing Code  
(Part 5, Title 24, California Code of Regulations)**

**January 2, 2008 Errata**

It is suggested that the section number as well as the page number be checked when inserting this material and removing the superseded material. In case of doubt, rely on the section numbers rather than the page numbers since the section numbers must run consecutively.

It is further suggested that the superseded material be retained with this revision record sheet so that the prior wording of any section can be easily ascertained.

Please keep the removed page(s) with this revision for future reference.

**Remove Old Pages**

vii, xv, xix  
52  
78  
127 – 128  
193 – 221  
—  
403, 404  
493

**Insert New Pages**

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352.1 – 352.12  
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**CHAPTER 3 – GENERAL PROVISIONS**

Adopting Agency		BSC	SFM	HCD			DSA		OSHDPD				AGR	CA	CSA	DHS	DWR
				1	2	1/AC	AC	SS	1	2	3	4					
Adopt Entire Chapter		<b>X</b>						<b>X</b>									
Adopt Entire Chapter as amended (amended sections listed below)				<b>X</b> <sup>1</sup>	<b>X</b> <sup>1</sup>				<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
Adopt only those sections that are listed below			<b>X</b>														
Article/Section	Codes																
301.2	UPC			<b>X</b>	<b>X</b>												
301.2.1	UPC			†	†												
301.2.1.1	UPC			†	†												
301.2.1.2	UPC			†	†												
301.5	CA			<b>X</b>	<b>X</b>												
303.0 Exc.	CA			<b>X</b>	<b>X</b>												
304.0 Exc.	CA			<b>X</b>	<b>X</b>												
311.9	CA								<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
311.10	CA								<b>X</b>		<b>X</b>	<b>X</b>					
311.11	CA		<b>X</b>														
311.12	CA								<b>X</b>	<b>X</b>		<b>X</b>					
316.1.6	UPC			<b>X</b>	<b>X</b>												
316.1.8	CA								†	†	†	†					
316.1.9	CA		<b>X</b>						†	†	†	†					
316.2.4	CA			<b>X</b>	<b>X</b>				<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
320.0	CA								<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					

1. This state agency adopts the entire chapter as amended except for those sections indicated by the following symbol: †

**CHAPTER 10 – TRAPS AND INTERCEPTORS**

Adopting Agency		BSC	SFM	HCD			DSA		OSHDPD				AGR	CA	CSA	DHS	DWR
				1	2	1/AC	AC	SS	1	2	3	4					
Adopt Entire Chapter		<b>X</b>		<b>X</b>	<b>X</b>			<b>X</b>									
Adopt Entire Chapter as amended (amended sections listed below)									<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>				
Adopt only those sections that are listed below																	
Article/Section	Codes																
1010.1	CA												<b>X</b>				
1010.2	CA												<b>X</b>				
1010.3	CA												<b>X</b>				
1010.4	CA												<b>X</b>				
1014.1A	CA								<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
1014.1B	CA								<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
1014.1C	CA								<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
1015.6	CA								<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
1015.7	CA								<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					

**CHAPTER 11 – STORM DRAINAGE**

Adopting Agency		BSC	SFM	HCD			DSA		OSHDPD				AGR	CA	CSA	DHS	DWR
				1	2	1/AC	AC	SS	1	2	3	4					
Adopt Entire Chapter		<b>X</b>						<b>X</b>									
Adopt Entire Chapter as amended (amended sections listed below)				<b>X</b>	<b>X</b>				<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
Adopt only those sections that are listed below																	
Article/Section	Codes																
1101.3	CA			<b>X</b>	<b>X</b>												
1101.3.1	CA								<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
1101.5.1 Exc.	CA			<b>X</b>	<b>X</b>												
1102.1.2	CA			<b>X</b>	<b>X</b>				<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					

**CHAPTER 12 – FUEL PIPING**

Adopting Agency		BSC	SFM	HCD			DSA		OSHDPD				AGR	CA	CSA	DHS	DWR
				1	2	1/AC	AC	SS	1	2	3	4					
Adopt Entire Chapter		<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>				<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
Adopt Entire Chapter as amended (amended sections listed below)								<b>X</b>									
Adopt only those sections that are listed below																	
Article/Section	Codes																
1203.10	CA							<b>X</b>									
1211.13.5	CA																
1211.16																	
1211.18	CA							<b>X</b>									

**CHAPTER 13 – HEALTH CARE FACILITIES AND MEDICAL GAS AND VACUUM SYSTEMS**

Adopting Agency		BSC	SFM	HCD			DSA		OSHDPD				AGR	CA	CSA	DHS	DWR
				1	2	1/AC	AC	SS	1	2	3	4					
Adopt Entire Chapter		<b>X</b>	<b>X</b>														
Adopt Entire Chapter as amended (amended sections listed below)									<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					
Adopt only those sections that are listed below																	
Article/Section	Codes																
1301.2	CA								<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>					

**TABLE 4-3**

Type of Building or Occupancy	Water Closets (Fixtures per Person)		Urinals (Trough urinal to individual urinal equivalence) Male	Lavatories (Fixtures per Person)	Bathtubs or Showers (Fixtures per Person) <sup>7</sup>	Drinking Fountains (Fixtures per Person) <sup>3</sup>
	Male	Female				
Nonindustrial—office buildings, public buildings and similar establishments	1 1-15 2 16-35 3 36-55  4 56-80 5 81-110 6 111-150 1 additional for each additional 40 employees or fraction thereof	1 1-15 2 16-35 3 36-55  4 56-80 5 81-110 6 111-150	Length of trough urinal      Number of individual urinals 24" (610 mm).....1 36" (914 mm).....2 48" (1219 mm).....2 60" (1524 mm).....3 72" (1879 mm).....4	1 1-15 2 16-35 3 36-60  4 61-90 5 91-125 1 additional for each additional 4 employees or fraction thereof	1:10 persons per shift required to shower	—
Industrial—factories, warehouses, loft buildings and similar establishments	1 1-15 2 16-35 3 36-55 4 56-80 5 81-110 6 111-150 1 additional for each additional 40 employees or fraction thereof	1 1-15 2 16-35 3 36-55 4 56-80 5 81-110 6 111-150	24" (610 mm).....1 36" (914 mm).....2 48" (1219 mm).....2 60" (1524 mm).....3 72" (1829 mm).....4	1 to 100 employees 1 per 10  Over 100 employees 1 additional for each additional 15 employees or fraction thereof	1:10 persons per shift required to shower	—

1 The figures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction thereof.

2 Each water closet shall occupy a separate compartment which shall be equipped with a door, door latch and clothes hook. The door and the walls or partitions between fixtures shall be sufficient to assure privacy.

3 Drinking fountains shall not be located in toilet rooms.

4 Washing facilities shall be reasonably accessible to all employees.

5 Toilet facilities shall be accessible to the employees at all times. Where practicable, toilet facilities should be within 200 feet (61 m) of locations at which workers are regularly employed and should not be more than one floor-to-floor flight of stairs from working areas.

6 Urinals may be installed instead of water closets in toilet rooms to be used only by men provided that the number of water closets shall not be less than two thirds of the minimum number of toilet facilities specified. The length of trough urinals to the equivalent number of individual urinals shall be based on the above table.

7 When there are less than five employees, separate toilet rooms for each sex are not required provided toilet rooms can be locked from the inside and contain at least one water closet.

8 Twenty-four linear inches of wash sink or 18 inches of circular basin, when provided with water outlets for such space, shall be considered equivalent to one lavatory.

Exception: The requirements of Table 4-3 do not apply to mobile crews or to normally unattended work locations provided employees at these locations have immediately available transportation to nearby toilet facilities which meet the requirements of Table 4-3.

**TABLE 4-4**

Type of Building or Occupancy <sup>a</sup>	Water Closets (Fixtures per Person)		Urinals (Fixtures per Male)	Lavatories (Fixtures per Person)	Bathtubs or Showers (Fixtures per Person)	Drinking Fountains (Fixtures per Person)
Day Use Public Beaches <sup>1,2</sup>	Male 1 1-100 No sex designated 1 1-500 Minimum of 2	Female 1 1-100	May be substituted for up to two-thirds of the water closets required			
Picnic Areas	Male 1 1-50	Female 1 1-50				
Overnight Use Public Beaches <sup>2</sup>	1 1-7.5 campsites <sup>3</sup> 1 1-7.5 campsites <sup>3</sup>		May be substituted for up to one-third of the water closets required <sup>6</sup>		1 1-12.5 campsites <sup>4</sup>	
Organized Camps	1 1-15 <sup>3</sup>			1 1-15	1 1-156	Minimum 1 per camp

1 Toilets shall be located in accordance with actual use patterns on the beach. The reasonable intent of the toilet requirements is that it should apply on the basis of average daily use during periods of peak use. The health officer may determine how many days the population standard may be exceeded.

2 Laundry facilities are not required, but if they are provided, must be a minimum of two laundry trays or a washing machine.

3 Toilet facilities shall not be farther than 400 feet from any lot or campsite.

4 Showers are not required, but if provided, they shall be provided on the indicated ratio. Outdoor rinse-off showers may be cold water only.

5 Toilets shall be located within 300 feet from the living accommodations they serve.

6 Showers shall be provided in the living area or in a centrally located structure.

**Exception:** Intermittent short-term organized camps are not required to provide shower facilities, but if provided, they shall comply with this part.

bends or offsets shall have their maximum capacity further reduced in accordance with Section 511.1.2. The 20 percent reduction for corrugated metallic chimney liner systems includes an allowance for one long radius 90-degree turn at the bottom of the liner. [NFPA 54: 13.1.7]

**511.1.7** Where the vertical vent has a larger diameter than the vent connector, the vertical vent diameter shall be used to determine the minimum vent capacity, and the connector diameter shall be used to determine the maximum vent capacity. The flow area of the vertical vent shall not exceed seven times the flow area of the listed appliance categorized vent area, flue collar area, or draft hood outlet area unless designed in accordance with approved engineering methods. [NFPA 54: 13.1.9]

**511.1.8 Connection to Chimney Liners.** Connections between chimney liners and listed double-wall connectors shall be made with listed adapters designed for such purposes. [NFPA 54: 13.1.8]

**511.1.9 Vertical Vent Upsizing 7 x Rule.** Where the vertical vent has a larger diameter than the vent connector, the vertical vent diameter shall be used to determine the minimum vent capacity, and the connector diameter shall be used to determine the maximum vent capacity. The flow area of the vertical vent shall not exceed seven times the flow area of the listed appliance categorized vent area, flue collar area, or draft hood outlet area unless designed in accordance with approved engineering methods. [NFPA 54: 13.1.9]

**511.1.10 Draft Hood Conversion Accessories.** Draft hood conversion accessories for use with masonry chimneys venting listed Category I fan-assisted appliances shall be listed and installed in accordance with the listed accessory manufacturers' installation instructions. [NFPA 54: 13.1.10]

**511.1.11** Tables 5-8 through 5-12 shall be used for chimneys and vents not exposed to the outdoors below the roof line. A Type B vent or listed chimney lining system passing through an unused masonry chimney flue shall not be considered to be exposed to the outdoors. A Type B vent passing through an unventilated enclosure or chase insulated to a value of not less than R8 shall not be considered to be exposed to the outdoors. Table 5-10 in combination with Table 5-13 shall be used for clay-tile-lined exterior masonry chimneys, provided all of the following are met: [NFPA 54: 13.1.11]

- (1) The vent connector is Type B double wall.
- (2) The vent connector length is limited to 1-1/2 feet for each inch (180 mm/mm) of vent

connector diameter.

- (3) The appliance is draft-hood-equipped.
- (4) The input rating is less than the maximum capacity given in Table 5-10.
- (5) For a water heater, the outdoor design temperature shall not be less than 5°F (15°C).
- (6) For a space-heating appliance, the input rating is greater than the minimum capacity given by Table 5-13.
- (7) Where the conditions of (1) through (6) cannot be met, an alternative venting design shall be used, such as a listed chimney lining system.

**Exception:** Vents serving listed appliances installed in accordance with the appliance instructions and the terms of the listing.

**511.1.12** Corrugated vent connectors shall not be smaller than the listed appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter. [NFPA 54: 13.1.12]

**511.1.13** Vent connectors shall not be upsized more than two sizes greater than the listed appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter. [NFPA 54: 13.1.13]

**511.1.14** In a single run of vent or vent connector, more than one diameter and type shall be permitted to be used, provided that all the sizes and types are permitted by the tables. [NFPA 54: 13.1.14]

**511.1.15** Interpolation shall be permitted in calculating capacities for vent dimensions that fall between table entries. (See Part II-Example G.1.3.) [NFPA 54: 13.1.15]

**511.1.16** Extrapolation beyond the table entries shall not be permitted. [NFPA 54: 13.1.16]

**511.1.17** For vent heights lower than 6 feet and higher than shown in the tables, engineering methods shall be used to calculate vent capacities. [NFPA 54: 13.1.17]

## **511.2 Additional Requirements to Multiple Appliance Vent Table 5-14 through Table 5-22.**

### **511.2.1 Obstructions and Vent Damper.**

These venting tables shall not be used where obstructions (see Section 510.15) are installed in the venting system. The installation of vents serving listed appliances with vent dampers shall be in accordance with the appliance manufacturers' instructions or in accordance with the following: [NFPA 54: 13.2.1]

- (1) The maximum capacity of the vent connector shall be determined using the NAT Max column.
- (2) The maximum capacity of the vertical vent

**612.0 [For OSHPD 1, 2, 3 & 4] Domestic Hot-water Distribution Systems for Health Facilities and Clinics.**

**612.1** The domestic water-heating equipment and distribution systems shall supply water at the temperature and amounts shown in Table 6-9. Where the system is designed by a mechanical engineer, appropriate diversity factors may be utilized.

**612.2** At least two pieces of hot-water-heating equipment shall be provided to supply hot water for dishwashing and minimum patient services such as handwashing and bathing. Booster heaters for 125°F. to 180°F. (52°C. to 82°C.) water are acceptable as a second piece of equipment for dishwashing.

**612.3** Instantaneous heaters are permitted for supplying hot water to handwashing and bathing fixtures if a continuous mechanical recirculation system is also provided.

**612.4** Water storage tanks shall be fabricated of corrosion-resistant materials or lined with corrosion-resistant materials.

**612.5** Temperature control valves shall be provided to automatically regulate the temperature of hot water delivered to plumbing fixtures used by patients to a range of 105°F (41°C) minimum to 120°F (49°C) maximum. High temperature alarm set at 125°F (52°C) shall be provided. The audible/visual device for the high temperature alarm shall annunciate at a continuously occupied location.

**612.6** Hot-water distribution system serving patient care areas shall be under constant mechanical recirculation to provide continuous hot water at each hot water outlet.

**612.7** At fixtures where water exceeding 125°F (52°C) is accessible to patients or personnel, warning signs in letters at least 2 inches (51 mm) high shall be posted above the fixtures.

**612.8** Sectionalizing valves shall be provided as required by Section 605.8.

**Table 6-9**  
**[For OSHPD 1, 2, 3 & 4] Hot Water Use**

	Clinical	Dietary <sup>1</sup>	Laundry <sup>2</sup>
Liter/Hour/Bed	11.9	7.2	7.6
Gallons/Hour/Bed	3	2	2
Temperature °C	41-49.0	49.0	71.0
Temperature °F	105-120.0	120.0	160.0

- <sup>1</sup> Rinse water temperature at automatic dishwashing equipment and pot sinks shall be 180°F (82°C).

**Exception:** The rinse water supply to pot rinse sinks may be deleted if a method of chemical disinfection using a three-compartment sink is proposed.

- <sup>2</sup> The required temperature of 160°F (71°C) in the laundry is that measure in the washing machine and shall be supplied so that the temperature may be maintained over the entire wash and rinse period.

**Exception:** A lower water temperature of 140°F (60°C) may be utilized, provided linens are subsequently passed through a tumbler dryer at 180°F (82°C) or a flatwork ironer at 300°F (149°C).

**Table 6-7**  
**Flushometer Fixture Units for Water Sizing Using Table 6-5**

<b>Fixture Category: Water Closet w/ Flushometer Valves</b>		
Number of Flushometer Valves	Individual Fixture Units Assigned in Decreasing Value	Fixture Units Assigned for Water Closets and Similar 10-Unit Fixtures in Accumulative Values
1	40	40
2	30	70
3	20	90
4	15	105
5 or more	10 each	115 plus 10 for each additional fixture in excess of 5

<b>Fixture Category: Urinals w/ Flushometer Valves</b>		
Number of Flushometer Valves	Individual Fixture Units Assigned in Decreasing Value	Fixture Units Assigned for Urinals and Similar 5-Unit Fixtures in Accumulative Values
1	20	20
2	15	35
3	10	45
4	8	53
5 or more	5 each	58 plus 5 for each additional fixture in excess of 5

**TABLE 6-8**  
**Sizing of Residential Water Softeners**

Required Size of Softener Connection	Number of Bathroom Groups Served <sup>1</sup>
3/4 in.	up to 2 <sup>2</sup>
1 in.	up to 4 <sup>3</sup>

- <sup>1</sup> Installation of a kitchen sink and dishwasher, laundry tray, and automatic clothes washer permitted without additional size increase.

- <sup>2</sup> An additional water closet and lavatory permitted.

- <sup>3</sup> Over four bathroom groups, the softener size shall be engineered for the specific installation.

See also Appendix A, Recommended Rules for Sizing the Water Supply System, and Appendix L, Alternate Plumbing Systems, for alternate methods of sizing water supply systems.



**613.0 Dialysis Water-Distribution Systems.**

**613.1 [For OSHPD 1, 2, 3, & 4]** Dialysis water feedlines shall be PVC (polyvinyl chloride), glass or stainless steel and sized to provide a minimum velocity of 1.5 feet per second (0.46 m/s). The piping shall be a singleloop system with or without recirculation. Branches to dialysis machines shall be 1/4 inch (6.4 mm) inside dimension and take off from the bottom of the main feedline.

**613.2** All piping for multistation or central dialysis units shall be rigid where possible. All piping and tubing shall be in a neat arrangement. The placement of piping or tubing on the floor is not permitted.

**613.3** All valves shall be located in accessible locations.

**613.4** Piping and valves shall be identified according to their function.

**613.5** A means of preventing backwashing or flushing of the system when one or more stations are in operation shall be provided.

**613.6** A continuous audible alarm shall sound at the nurses' station and remote equipment rooms when the minimum velocity is not maintained, or if backwashing or flushing is attempted while one or more stations are in operation.

**613.7** Dialysis water is the water used for dialysis treatment and which meets the standards established by the American Association of Medical Instrumentation, 1992, or the Recommended Interim Products Water Standard for Hemodialysis, as established by the United States Food and Drug Administration, 1980.

**613.8** A diagram of all piping as installed shall be posted at the nurses' station and equipment room of all multistation or central dialysis units.

**614.0 Identification of Potable and Nonpotable Water Lines.****614.1 Uses Not Permitted.**

**614.1.1 [For OSHPD 1, 2, 3 & 4]** Nonpotable water shall not be piped for drinking, washing or bathing, washing of clothing, cooking, washing of food, washing of cooking or eating utensils, washing of food preparation or processing premises, or other personal service rooms.

**614.2 [For OSHPD 1, 2, 3 & 4]** Nonpotable water systems or systems carrying any other nonpotable substance shall be installed so as to prevent backflow or backsiphonage into a potable water system.

**614.3 [For OSHPD 1, 2, 3 & 4]** Outlets for nonpotable water, such as water for industrial or fire-fighting purposes, shall be posted in a manner understandable to all employees to indicate that the water is unsafe and shall not be used for drinking, washing, cooking or other personal service purposes.

**614.4 [For OSHPD 1] Emergency Water Supply.**

**614.4.1** For acute care hospital facilities required to meet NPC-5, an on site water supply of 150 gallons

(567.9 L) (based on 50 gallons/day/bed for 72 hours) of potable water per licensed bed shall be provided.

The emergency supply shall have fittings to allow for replenishment of the water supply from transportable water sources and a means to collect water in portable containers in the event that normal water supply becomes unavailable.

**Exceptions:** 1. With the licensing agency approval of a water rationing plan, the emergency water storage capacity may be computed based on the approved water rationing plan to provide for 72 hours of operation

2. With the approval of the Office and the licensing agency, hook-ups that allow for the use of transportable sources of potable water may be provided in lieu of on-site storage.

**614.4.2** The emergency supply of water shall be provided at adequate pressure using gravity, pressure tanks or booster pumps. Pumps used for this purpose shall be provided with electrical power from the on site emergency system.



**Table 12-7**  
**Schedule 40 Metallic Pipe [NFPA 54: Table 6.2(a)]**

											Gas:	Natural		
											Inlet Pressure:	Less than 2 psi		
											Pressure Drop:	0.3 in. w.c.		
											Specific Gravity:	0.60		
	Pipe Size (in.)													
Nominal:	½	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12
Actual ID:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	5.047	6.065	7.981	10.020	11.938
Length (ft)	Capacity in Cubic Feet of Gas per Hour													
10	131	273	514	1,060	1,580	3,050	4,860	8,580	17,500	31,700	51,300	105,000	191,000	303,000
20	90	188	353	726	1,090	2,090	3,340	5,900	12,000	21,800	35,300	72,400	132,000	208,000
30	72	151	284	583	873	1,680	2,680	4,740	9,660	17,500	28,300	58,200	106,000	167,000
40	62	129	243	499	747	1,440	2,290	4,050	8,270	15,000	24,200	49,800	90,400	143,000
50	55	114	215	442	662	1,280	2,030	3,590	7,330	13,300	21,500	44,100	80,100	127,000
60	50	104	195	400	600	1,160	1,840	3,260	6,640	12,000	19,500	40,000	72,600	115,000
70	46	95	179	368	552	1,060	1,690	3,000	6,110	11,100	17,900	36,800	66,800	106,000
80	42	89	167	343	514	989	1,580	2,790	5,680	10,300	16,700	34,200	62,100	98,400
90	40	83	157	322	482	928	1,480	2,610	5,330	9,650	15,600	32,100	58,300	92,300
100	38	79	148	304	455	877	1,400	2,470	5,040	9,110	14,800	30,300	55,100	87,200
125	33	70	131	269	403	777	1,240	2,190	4,460	8,080	13,100	26,900	48,800	77,300
150	30	63	119	244	366	704	1,120	1,980	4,050	7,320	11,900	24,300	44,200	70,000
175	28	58	109	224	336	648	1,030	1,820	3,720	6,730	10,900	22,400	40,700	64,400
200	26	54	102	209	313	602	960	1,700	3,460	6,260	10,100	20,800	37,900	59,900
250	23	48	90	185	277	534	851	1,500	3,070	5,550	8,990	18,500	33,500	53,100
300	21	43	82	168	251	484	771	1,360	2,780	5,030	8,150	16,700	30,400	48,100
350	19	40	75	154	231	445	709	1,250	2,560	4,630	7,490	15,400	28,000	44,300
400	18	37	70	143	215	414	660	1,170	2,380	4,310	6,970	14,300	26,000	41,200
450	17	35	66	135	202	389	619	1,090	2,230	4,040	6,540	13,400	24,400	38,600
500	16	33	62	127	191	367	585	1,030	2,110	3,820	6,180	12,700	23,100	36,500
550	15	31	59	121	181	349	556	982	2,000	3,620	5,870	12,100	21,900	34,700
600	14	30	56	115	173	333	530	937	1,910	3,460	5,600	11,500	20,900	33,100
650	14	29	54	110	165	318	508	897	1,830	3,310	5,360	11,000	20,000	31,700
700	13	27	52	106	159	306	488	862	1,760	3,180	5,150	10,600	19,200	30,400
750	13	26	50	102	153	295	470	830	1,690	3,060	4,960	10,200	18,500	29,300
800	12	26	48	99	148	285	454	802	1,640	2,960	4,790	9,840	17,900	28,300
850	12	25	46	95	143	275	439	776	1,580	2,860	4,640	9,530	17,300	27,400
900	11	24	45	93	139	267	426	752	1,530	2,780	4,500	9,240	16,800	26,600
950	11	23	44	90	135	259	413	731	1,490	2,700	4,370	8,970	16,300	25,800
1,000	11	23	43	87	131	252	402	711	1,450	2,620	4,250	8,720	15,800	25,100
1,100	10	21	40	83	124	240	382	675	1,380	2,490	4,030	8,290	15,100	23,800
1,200	NA	20	39	79	119	229	364	644	1,310	2,380	3,850	7,910	14,400	22,700
1,300	NA	20	37	76	114	219	349	617	1,260	2,280	3,680	7,570	13,700	21,800
1,400	NA	19	35	73	109	210	335	592	1,210	2,190	3,540	7,270	13,200	20,900
1,500	NA	18	34	70	105	203	323	571	1,160	2,110	3,410	7,010	12,700	20,100
1,600	NA	18	33	68	102	196	312	551	1,120	2,030	3,290	6,770	12,300	19,500
1,700	NA	17	32	66	98	189	302	533	1,090	1,970	3,190	6,550	11,900	18,800
1,800	NA	16	31	64	95	184	293	517	1,050	1,910	3,090	6,350	11,500	18,300
1,900	NA	16	30	62	93	178	284	502	1,020	1,850	3,000	6,170	11,200	17,700
2,000	NA	16	29	60	90	173	276	488	1,000	1,800	2,920	6,000	10,900	17,200

NA means a flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

**Table 12-8**  
**Schedule 40 Metallic Pipe [NFPA 54: Table 6.2(b)]**

												Gas:	Natural	
												Inlet Pressure:	Less than 2 psi	
												Pressure Drop:	0.5 in. w.c.	
												Specific Gravity:	0.60	
Pipe Size (in.)														
Nominal:	½	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12
Actual ID:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	5.047	6.065	7.981	10.020	11.938
Length (ft)	Capacity in Cubic Feet of Gas per Hour													
10	172	360	678	1,390	2,090	4,020	6,400	11,300	23,100	41,800	67,600	139,000	252,000	399,000
20	118	247	466	957	1,430	2,760	4,400	7,780	15,900	28,700	46,500	95,500	173,000	275,000
30	95	199	374	768	1,150	2,220	3,530	6,250	12,700	23,000	37,300	76,700	139,000	220,000
40	81	170	320	657	985	1,900	3,020	5,350	10,900	19,700	31,900	65,600	119,000	189,000
50	72	151	284	583	873	1,680	2,680	4,740	9,660	17,500	28,300	58,200	106,000	167,000
60	65	137	257	528	791	1,520	2,430	4,290	8,760	15,800	25,600	52,700	95,700	152,000
70	60	126	237	486	728	1,400	2,230	3,950	8,050	14,600	23,600	48,500	88,100	139,000
80	56	117	220	452	677	1,300	2,080	3,670	7,490	13,600	22,000	45,100	81,900	130,000
90	52	110	207	424	635	1,220	1,950	3,450	7,030	12,700	20,600	42,300	76,900	122,000
100	50	104	195	400	600	1,160	1,840	3,260	6,640	12,000	19,500	40,000	72,600	115,000
125	44	92	173	355	532	1,020	1,630	2,890	5,890	10,600	17,200	35,400	64,300	102,000
150	40	83	157	322	482	928	1,480	2,610	5,330	9,650	15,600	32,100	58,300	92,300
175	37	77	144	296	443	854	1,360	2,410	4,910	8,880	14,400	29,500	53,600	84,900
200	34	71	134	275	412	794	1,270	2,240	4,560	8,260	13,400	27,500	49,900	79,000
250	30	63	119	244	366	704	1,120	1,980	4,050	7,320	11,900	24,300	44,200	70,000
300	27	57	108	221	331	638	1,020	1,800	3,670	6,630	10,700	22,100	40,100	63,400
350	25	53	99	203	305	587	935	1,650	3,370	6,100	9,880	20,300	36,900	58,400
400	23	49	92	189	283	546	870	1,540	3,140	5,680	9,190	18,900	34,300	54,300
450	22	46	86	177	266	512	816	1,440	2,940	5,330	8,620	17,700	32,200	50,900
500	21	43	82	168	251	484	771	1,360	2,780	5,030	8,150	16,700	30,400	48,100
550	20	41	78	159	239	459	732	1,290	2,640	4,780	7,740	15,900	28,900	45,700
600	19	39	74	152	228	438	699	1,240	2,520	4,560	7,380	15,200	27,500	43,600
650	18	38	71	145	218	420	669	1,180	2,410	4,360	7,070	14,500	26,400	41,800
700	17	36	68	140	209	403	643	1,140	2,320	4,190	6,790	14,000	25,300	40,100
750	17	35	66	135	202	389	619	1,090	2,230	4,040	6,540	13,400	24,400	38,600
800	16	34	63	130	195	375	598	1,060	2,160	3,900	6,320	13,000	23,600	37,300
850	16	33	61	126	189	363	579	1,020	2,090	3,780	6,110	12,600	22,800	36,100
900	15	32	59	122	183	352	561	992	2,020	3,660	5,930	12,200	22,100	35,000
950	15	31	58	118	178	342	545	963	1,960	3,550	5,760	11,800	21,500	34,000
1,000	14	30	56	115	173	333	530	937	1,910	3,460	5,600	11,500	20,900	33,100
1,100	14	28	53	109	164	316	503	890	1,810	3,280	5,320	10,900	19,800	31,400
1,200	13	27	51	104	156	301	480	849	1,730	3,130	5,070	10,400	18,900	30,000
1,300	12	26	49	100	150	289	460	813	1,660	3,000	4,860	9,980	18,100	28,700
1,400	12	25	47	96	144	277	442	781	1,590	2,880	4,670	9,590	17,400	27,600
1,500	11	24	45	93	139	267	426	752	1,530	2,780	4,500	9,240	16,800	26,600
1,600	11	23	44	89	134	258	411	727	1,480	2,680	4,340	8,920	16,200	25,600
1,700	11	22	42	86	130	250	398	703	1,430	2,590	4,200	8,630	15,700	24,800
1,800	10	22	41	84	126	242	386	682	1,390	2,520	4,070	8,370	15,200	24,100
1,900	10	21	40	81	122	235	375	662	1,350	2,440	3,960	8,130	14,800	23,400
2,000	NA	20	39	79	119	229	364	644	1,310	2,380	3,850	7,910	14,400	22,700

NA means a flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

**Table 12-9**  
**Schedule 40 Metallic Pipe [NFPA 54: Table 6.2(c)]**

	Gas: Natural								
	Inlet Pressure: 2.0 psi								
	Pressure Drop: 1.0 psi								
	Specific Gravity: 0.60								
	Pipe Size (in.)								
Nominal:	½	¾	1	1¼	1½	2	2½	3	4
Actual ID:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Cubic Feet of Gas per Hour								
10	1,510	3,040	5,560	11,400	17,100	32,900	52,500	92,800	189,000
20	1,070	2,150	3,930	8,070	12,100	23,300	37,100	65,600	134,000
30	869	1,760	3,210	6,590	9,880	19,000	30,300	53,600	109,000
40	753	1,520	2,780	5,710	8,550	16,500	26,300	46,400	94,700
50	673	1,360	2,490	5,110	7,650	14,700	23,500	41,500	84,700
60	615	1,240	2,270	4,660	6,980	13,500	21,400	37,900	77,300
70	569	1,150	2,100	4,320	6,470	12,500	19,900	35,100	71,600
80	532	1,080	1,970	4,040	6,050	11,700	18,600	32,800	67,000
90	502	1,010	1,850	3,810	5,700	11,000	17,500	30,900	63,100
100	462	934	1,710	3,510	5,260	10,100	16,100	28,500	58,200
125	414	836	1,530	3,140	4,700	9,060	14,400	25,500	52,100
150	372	751	1,370	2,820	4,220	8,130	13,000	22,900	46,700
175	344	695	1,270	2,601	3,910	7,530	12,000	21,200	43,300
200	318	642	1,170	2,410	3,610	6,960	11,100	19,600	40,000
250	279	583	1,040	2,140	3,210	6,180	9,850	17,400	35,500
300	253	528	945	1,940	2,910	5,600	8,920	15,800	32,200
350	232	486	869	1,790	2,670	5,150	8,210	14,500	29,600
400	216	452	809	1,660	2,490	4,790	7,640	13,500	27,500
450	203	424	759	1,560	2,330	4,500	7,170	12,700	25,800
500	192	401	717	1,470	2,210	4,250	6,770	12,000	24,400
550	182	381	681	1,400	2,090	4,030	6,430	11,400	23,200
600	174	363	650	1,330	2,000	3,850	6,130	10,800	22,100
650	166	348	622	1,280	1,910	3,680	5,870	10,400	21,200
700	160	334	598	1,230	1,840	3,540	5,640	9,970	20,300
750	154	322	576	1,180	1,770	3,410	5,440	9,610	19,600
800	149	311	556	1,140	1,710	3,290	5,250	9,280	18,900
850	144	301	538	1,100	1,650	3,190	5,080	8,980	18,300
900	139	292	522	1,070	1,600	3,090	4,930	8,710	17,800
950	135	283	507	1,040	1,560	3,000	4,780	8,460	17,200
1,000	132	275	493	1,010	1,520	2,920	4,650	8,220	16,800
1,100	125	262	468	960	1,440	2,770	4,420	7,810	15,900
1,200	119	250	446	917	1,370	2,640	4,220	7,450	15,200
1,300	114	239	427	878	1,320	2,530	4,040	7,140	14,600
1,400	110	230	411	843	1,260	2,430	3,880	6,860	14,000
1,500	106	221	396	812	1,220	2,340	3,740	6,600	13,500
1,600	102	214	382	784	1,180	2,260	3,610	6,380	13,000
1,700	99	207	370	759	1,140	2,190	3,490	6,170	12,600
1,800	96	200	358	736	1,100	2,120	3,390	5,980	12,200
1,900	93	195	348	715	1,070	2,060	3,290	5,810	11,900
2,000	91	189	339	695	1,040	2,010	3,200	5,650	11,500

Note: All table entries are rounded to 3 significant digits.



**Table 12-10**  
**Schedule 40 Metallic Pipe [NFPA 54: Table 6.2(d)]**

	Gas: Natural								
	Inlet Pressure: 3.0 psi								
	Pressure Drop: 2.0 psi								
	Specific Gravity: 0.60								
	Pipe Size (in.)								
Nominal:	½	¾	1	1¼	1½	2	2½	3	4
Actual ID:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Cubic Feet of Gas per Hour								
10	2,350	4,920	9,270	19,000	28,500	54,900	87,500	155,000	316,000
20	1,620	3,380	6,370	13,100	19,600	37,700	60,100	106,000	217,000
30	1,300	2,720	5,110	10,500	15,700	30,300	48,300	85,400	174,000
40	1,110	2,320	4,380	8,990	13,500	25,900	41,300	73,100	149,000
50	985	2,060	3,880	7,970	11,900	23,000	36,600	64,800	132,000
60	892	1,870	3,520	7,220	10,800	20,800	33,200	58,700	120,000
70	821	1,720	3,230	6,640	9,950	19,200	30,500	54,000	110,000
80	764	1,600	3,010	6,180	9,260	17,800	28,400	50,200	102,000
90	717	1,500	2,820	5,800	8,680	16,700	26,700	47,100	96,100
100	677	1,420	2,670	5,470	8,200	15,800	25,200	44,500	90,800
125	600	1,250	2,360	4,850	7,270	14,000	22,300	39,500	80,500
150	544	1,140	2,140	4,400	6,590	12,700	20,200	35,700	72,900
175	500	1,050	1,970	4,040	6,060	11,700	18,600	32,900	67,100
200	465	973	1,830	3,760	5,640	10,900	17,300	30,600	62,400
250	412	862	1,620	3,330	5,000	9,620	15,300	27,100	55,300
300	374	781	1,470	3,020	4,530	8,720	13,900	24,600	50,100
350	344	719	1,350	2,780	4,170	8,020	12,800	22,600	46,100
400	320	669	1,260	2,590	3,870	7,460	11,900	21,000	42,900
450	300	627	1,180	2,430	3,640	7,000	11,200	19,700	40,200
500	283	593	1,120	2,290	3,430	6,610	10,500	18,600	38,000
550	269	563	1,060	2,180	3,260	6,280	10,000	17,700	36,100
600	257	537	1,010	2,080	3,110	5,990	9,550	16,900	34,400
650	246	514	969	1,990	2,980	5,740	9,150	16,200	33,000
700	236	494	931	1,910	2,860	5,510	8,790	15,500	31,700
750	228	476	897	1,840	2,760	5,310	8,470	15,000	30,500
800	220	460	866	1,780	2,660	5,130	8,180	14,500	29,500
850	213	445	838	1,720	2,580	4,960	7,910	14,000	28,500
900	206	431	812	1,670	2,500	4,810	7,670	13,600	27,700
950	200	419	789	1,620	2,430	4,670	7,450	13,200	26,900
1,000	195	407	767	1,580	2,360	4,550	7,240	12,800	26,100
1,100	185	387	729	1,500	2,240	4,320	6,890	12,200	24,800
1,200	177	369	695	1,430	2,140	4,120	6,570	11,600	23,700
1,300	169	353	666	1,370	2,050	3,940	6,290	11,100	22,700
1,400	162	340	640	1,310	1,970	3,790	6,040	10,700	21,800
1,500	156	327	616	1,270	1,900	3,650	5,820	10,300	21,000
1,600	151	316	595	1,220	1,830	3,530	5,620	10,000	20,300
1,700	146	306	576	1,180	1,770	3,410	5,440	9,610	19,600
1,800	142	296	558	1,150	1,720	3,310	5,270	9,320	19,000
1,900	138	288	542	1,110	1,670	3,210	5,120	9,050	18,400
2,000	134	280	527	1,080	1,620	3,120	4,980	8,800	18,000

Note: All table entries are rounded to 3 significant digits.

**Table 12-11**  
**Schedule 40 Metallic Pipe [NFPA 54: Table 6.2(e)]**

						Gas:		Natural	
						Inlet Pressure:		5.0 psi	
						Pressure Drop:		3.5 psi	
						Specific Gravity:		0.60	
	Pipe Size (in.)								
Nominal:	½	¾	1	1¼	1½	2	2½	3	4
Actual ID:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Cubic Feet of Gas per Hour								
10	3,190	6,430	11,800	24,200	36,200	69,700	111,000	196,000	401,000
20	2,250	4,550	8,320	17,100	25,600	49,300	78,600	139,000	283,000
30	1,840	3,720	6,790	14,000	20,900	40,300	64,200	113,000	231,000
40	1,590	3,220	5,880	12,100	18,100	34,900	55,600	98,200	200,000
50	1,430	2,880	5,260	10,800	16,200	31,200	49,700	87,900	179,000
60	1,300	2,630	4,800	9,860	14,800	28,500	45,400	80,200	164,000
70	1,200	2,430	4,450	9,130	13,700	26,400	42,000	74,300	151,000
80	1,150	2,330	4,260	8,540	12,800	24,700	39,300	69,500	142,000
90	1,060	2,150	3,920	8,050	12,100	23,200	37,000	65,500	134,000
100	979	1,980	3,620	7,430	11,100	21,400	34,200	60,400	123,000
125	876	1,770	3,240	6,640	9,950	19,200	30,600	54,000	110,000
150	786	1,590	2,910	5,960	8,940	17,200	27,400	48,500	98,900
175	728	1,470	2,690	5,520	8,270	15,900	25,400	44,900	91,600
200	673	1,360	2,490	5,100	7,650	14,700	23,500	41,500	84,700
250	558	1,170	2,200	4,510	6,760	13,000	20,800	36,700	74,900
300	506	1,060	1,990	4,090	6,130	11,800	18,800	33,300	67,800
350	465	973	1,830	3,760	5,640	10,900	17,300	30,600	62,400
400	433	905	1,710	3,500	5,250	10,100	16,100	28,500	58,100
450	406	849	1,600	3,290	4,920	9,480	15,100	26,700	54,500
500	384	802	1,510	3,100	4,650	8,950	14,300	25,200	51,500
550	364	762	1,440	2,950	4,420	8,500	13,600	24,000	48,900
600	348	727	1,370	2,810	4,210	8,110	12,900	22,900	46,600
650	333	696	1,310	2,690	4,030	7,770	12,400	21,900	44,600
700	320	669	1,260	2,590	3,880	7,460	11,900	21,000	42,900
750	308	644	1,210	2,490	3,730	7,190	11,500	20,300	41,300
800	298	622	1,170	2,410	3,610	6,940	11,100	19,600	39,900
850	288	602	1,130	2,330	3,490	6,720	10,700	18,900	38,600
900	279	584	1,100	2,260	3,380	6,520	10,400	18,400	37,400
950	271	567	1,070	2,190	3,290	6,330	10,100	17,800	36,400
1,000	264	551	1,040	2,130	3,200	6,150	9,810	17,300	35,400
1,100	250	524	987	2,030	3,030	5,840	9,320	16,500	33,600
1,200	239	500	941	1,930	2,900	5,580	8,890	15,700	32,000
1,300	229	478	901	1,850	2,770	5,340	8,510	15,000	30,700
1,400	220	460	866	1,780	2,660	5,130	8,180	14,500	29,500
1,500	212	443	834	1,710	2,570	4,940	7,880	13,900	28,400
1,600	205	428	806	1,650	2,480	4,770	7,610	13,400	27,400
1,700	198	414	780	1,600	2,400	4,620	7,360	13,000	26,500
1,800	192	401	756	1,550	2,330	4,480	7,140	12,600	25,700
1,900	186	390	734	1,510	2,260	4,350	6,930	12,300	25,000
2,000	181	379	714	1,470	2,200	4,230	6,740	11,900	24,300

Note: All table entries are rounded to 3 significant digits.

**Table 12-12**  
**Semi-Rigid Copper Tubing [NFPA 54: Table 6.2(f)]**

								Gas:		Natural	
								Inlet Pressure:		Less than 2 ps	
								Pressure Drop:		0.3 in. w.c.	
								Specific Gravity:		0.60	
		Tube Size (in.)									
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2	
	ACR:	⅜	½	⅝	¾	⅞	1½	1¾	—	—	
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125	
Inside: <sup>a</sup>		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959	
Length (ft)		Capacity in Cubic Feet of Gas per Hour									
10		20	42	85	148	210	448	806	1,270	2,650	
20		14	29	58	102	144	308	554	873	1,820	
30		11	23	47	82	116	247	445	701	1,460	
40		10	20	40	70	99	211	381	600	1,250	
50		NA	17	35	62	88	187	337	532	1,110	
60		NA	16	32	56	79	170	306	482	1,000	
70		NA	14	29	52	73	156	281	443	924	
80		NA	13	27	48	68	145	262	413	859	
90		NA	13	26	45	64	136	245	387	806	
100		NA	12	24	43	60	129	232	366	761	
125		NA	11	22	38	53	114	206	324	675	
150		NA	10	20	34	48	103	186	294	612	
175		NA	NA	18	31	45	95	171	270	563	
200		NA	NA	17	29	41	89	159	251	523	
250		NA	NA	15	26	37	78	141	223	464	
300		NA	NA	13	23	33	71	128	202	420	
350		NA	NA	12	22	31	65	118	186	387	
400		NA	NA	11	20	28	61	110	173	360	
450		NA	NA	11	19	27	57	103	162	338	
500		NA	NA	10	18	25	54	97	153	319	
550		NA	NA	NA	17	24	51	92	145	303	
600		NA	NA	NA	16	23	49	88	139	289	
650		NA	NA	NA	15	22	47	84	133	277	
700		NA	NA	NA	15	21	45	81	128	266	
750		NA	NA	NA	14	20	43	78	123	256	
800		NA	NA	NA	14	20	42	75	119	247	
850		NA	NA	NA	13	19	40	73	115	239	
900		NA	NA	NA	13	18	39	71	111	232	
950		NA	NA	NA	13	18	38	69	108	225	
1,000		NA	NA	NA	12	17	37	67	105	219	
1,100		NA	NA	NA	12	16	35	63	100	208	
1,200		NA	NA	NA	11	16	34	60	95	199	
1,300		NA	NA	NA	11	15	32	58	91	190	
1,400		NA	NA	NA	10	14	31	56	88	183	
1,500		NA	NA	NA	NA	14	30	54	84	176	
1,600		NA	NA	NA	NA	13	29	52	82	170	
1,700		NA	NA	NA	NA	13	28	50	79	164	
1,800		NA	NA	NA	NA	13	27	49	77	159	
1,900		NA	NA	NA	NA	12	26	47	74	155	
2,000		NA	NA	NA	NA	12	25	46	72	151	

NA means a flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

<sup>a</sup>Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.



**Table 12-13**  
**Semi-Rigid Copper Tubing [NFPA 54: Table 6.2(g)]**

		Gas: Natural								
		Inlet Pressure: Less than 2 psi								
		Pressure Drop: 0.5 in. w.c.								
		Specific Gravity: 0.60								
		Tube Size (in.)								
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅝	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
10		27	55	111	195	276	590	1,060	1,680	3,490
20		18	38	77	134	190	406	730	1,150	2,400
30		15	30	61	107	152	326	586	925	1,930
40		13	26	53	92	131	279	502	791	1,650
50		11	23	47	82	116	247	445	701	1,460
60		10	21	42	74	105	224	403	635	1,320
70		NA	19	39	68	96	206	371	585	1,220
80		NA	18	36	63	90	192	345	544	1,130
90		NA	17	34	59	84	180	324	510	1,060
100		NA	16	32	56	79	170	306	482	1,000
125		NA	14	28	50	70	151	271	427	890
150		NA	13	26	45	64	136	245	387	806
175		NA	12	24	41	59	125	226	356	742
200		NA	11	22	39	55	117	210	331	690
250		NA	NA	20	34	48	103	186	294	612
300		NA	NA	18	31	44	94	169	266	554
350		NA	NA	16	28	40	86	155	245	510
400		NA	NA	15	26	38	80	144	228	474
450		NA	NA	14	25	35	75	135	214	445
500		NA	NA	13	23	33	71	128	202	420
550		NA	NA	13	22	32	68	122	192	399
600		NA	NA	12	21	30	64	116	183	381
650		NA	NA	12	20	29	62	111	175	365
700		NA	NA	11	20	28	59	107	168	350
750		NA	NA	11	19	27	57	103	162	338
800		NA	NA	10	18	26	55	99	156	326
850		NA	NA	10	18	25	53	96	151	315
900		NA	NA	NA	17	24	52	93	147	306
950		NA	NA	NA	17	24	50	90	143	297
1,000		NA	NA	NA	16	23	49	88	139	289
1,100		NA	NA	NA	15	22	46	84	132	274
1,200		NA	NA	NA	15	21	44	80	126	262
1,300		NA	NA	NA	14	20	42	76	120	251
1,400		NA	NA	NA	13	19	41	73	116	241
1,500		NA	NA	NA	13	18	39	71	111	232
1,600		NA	NA	NA	13	18	38	68	108	224
1,700		NA	NA	NA	12	17	37	66	104	217
1,800		NA	NA	NA	12	17	36	64	101	210
1,900		NA	NA	NA	11	16	35	62	98	204
2,000		NA	NA	NA	11	16	34	60	95	199

NA means a flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

\*Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.



**Table 12-14**  
**Semi-Rigid Copper Tubing [NFPA 54: Table 6.2(h)]**

							Gas:	Natural		
							Inlet Pressure:	Less than 2 psi		
							Pressure Drop:	1.0 in. w.c.		
							Specific Gravity:	0.60		
SPECIAL USE: Tube Sizing Between House Line Regulator and the Appliance.										
Tube Size (in.)										
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅝	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside: *		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
10		39	80	162	283	402	859	1,550	2,440	5,080
20		27	55	111	195	276	590	1,060	1,680	3,490
30		21	44	89	156	222	474	853	1,350	2,800
40		18	38	77	134	190	406	730	1,150	2,400
50		16	33	68	119	168	359	647	1,020	2,130
60		15	30	61	107	152	326	586	925	1,930
70		13	28	57	99	140	300	539	851	1,770
80		13	26	53	92	131	279	502	791	1,650
90		12	24	49	86	122	262	471	742	1,550
100		11	23	47	82	116	247	445	701	1,460
125		NA	20	41	72	103	219	394	622	1,290
150		NA	18	37	65	93	198	357	563	1,170
175		NA	17	34	60	85	183	329	518	1,080
200		NA	16	32	56	79	170	306	482	1,000
250		NA	14	28	50	70	151	271	427	890
300		NA	13	26	45	64	136	245	387	806
350		NA	12	24	41	59	125	226	356	742
400		NA	11	22	39	55	117	210	331	690
450		NA	10	21	36	51	110	197	311	647
500		NA	NA	20	34	48	103	186	294	612
550		NA	NA	19	32	46	98	177	279	581
600		NA	NA	18	31	44	94	169	266	554
650		NA	NA	17	30	42	90	162	255	531
700		NA	NA	16	28	40	86	155	245	510
750		NA	NA	16	27	39	83	150	236	491
800		NA	NA	15	26	38	80	144	228	474
850		NA	NA	15	26	36	78	140	220	459
900		NA	NA	14	25	35	75	135	214	445
950		NA	NA	14	24	34	73	132	207	432
1,000		NA	NA	13	23	33	71	128	202	420
1,100		NA	NA	13	22	32	68	122	192	399
1,200		NA	NA	12	21	30	64	116	183	381
1,300		NA	NA	12	20	29	62	111	175	365
1,400		NA	NA	11	20	28	59	107	168	350
1,500		NA	NA	11	19	27	57	103	162	338
1,600		NA	NA	10	18	26	55	99	156	326
1,700		NA	NA	10	18	25	53	96	151	315
1,800		NA	NA	NA	17	24	52	93	147	306
1,900		NA	NA	NA	17	24	50	90	143	297
2,000		NA	NA	NA	16	23	49	88	139	289

NA means a flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

\*Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

**Table 12-15**  
**Semi-Rigid Copper Tubing [NFPA 54: Table 6.2(i)]**

		Gas: Natural								
		Inlet Pressure: Less than 2.0 psi								
		Pressure Drop: 17.0 in. w.c.								
		Specific Gravity: 0.60								
		Tube Size (in.)								
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1½	1¾	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
10		190	391	796	1,390	1,970	4,220	7,590	12,000	24,900
20		130	269	547	956	1,360	2,900	5,220	8,230	17,100
30		105	216	439	768	1,090	2,330	4,190	6,610	13,800
40		90	185	376	657	932	1,990	3,590	5,650	11,800
50		79	164	333	582	826	1,770	3,180	5,010	10,400
60		72	148	302	528	749	1,600	2,880	4,540	9,460
70		66	137	278	486	689	1,470	2,650	4,180	8,700
80		62	127	258	452	641	1,370	2,460	3,890	8,090
90		58	119	243	424	601	1,280	2,310	3,650	7,590
100		55	113	229	400	568	1,210	2,180	3,440	7,170
125		48	100	203	355	503	1,080	1,940	3,050	6,360
150		44	90	184	321	456	974	1,750	2,770	5,760
175		40	83	169	296	420	896	1,610	2,540	5,300
200		38	77	157	275	390	834	1,500	2,370	4,930
250		33	69	140	244	346	739	1,330	2,100	4,370
300		30	62	126	221	313	670	1,210	1,900	3,960
350		28	57	116	203	288	616	1,110	1,750	3,640
400		26	53	108	189	268	573	1,030	1,630	3,390
450		24	50	102	177	252	538	968	1,530	3,180
500		23	47	96	168	238	508	914	1,440	3,000
550		22	45	91	159	226	482	868	1,370	2,850
600		21	43	87	152	215	460	829	1,310	2,720
650		20	41	83	145	206	441	793	1,250	2,610
700		19	39	80	140	198	423	762	1,200	2,500
750		18	38	77	135	191	408	734	1,160	2,410
800		18	37	74	130	184	394	709	1,120	2,330
850		17	35	72	126	178	381	686	1,080	2,250
900		17	34	70	122	173	370	665	1,050	2,180
950		16	33	68	118	168	359	646	1,020	2,120
1,000		16	32	66	115	163	349	628	991	2,060
1,100		15	31	63	109	155	332	597	941	1,960
1,200		14	29	60	104	148	316	569	898	1,870
1,300		14	28	57	100	142	303	545	860	1,790
1,400		13	27	55	96	136	291	524	826	1,720
1,500		13	26	53	93	131	280	505	796	1,660
1,600		12	25	51	89	127	271	487	768	1,600
1,700		12	24	49	86	123	262	472	744	1,550
1,800		11	24	48	84	119	254	457	721	1,500
1,900		11	23	47	81	115	247	444	700	1,460
2,000		11	22	45	79	112	240	432	681	1,420

Note: All table entries are rounded to 3 significant digits.

\*Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

**Table 12-16**  
**Semi-Rigid Copper Tubing [NFPA 54: Table 6.2(j)]**

		Gas: Natural								
		Inlet Pressure: 2.0 psi								
		Pressure Drop: 1.0 psi								
		Specific Gravity: 0.60								
		Tube Size (in.)								
Nominal:	K & L:	¼	⅜	½	¾	1	1¼	1½	2	
	ACR:	⅜	½	¾	1	1¼	1½	2	2½	
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
10		245	506	1,030	1,800	2,550	5,450	9,820	15,500	32,200
20		169	348	708	1,240	1,760	3,750	6,750	10,600	22,200
30		135	279	568	993	1,410	3,010	5,420	8,550	17,800
40		116	239	486	850	1,210	2,580	4,640	7,310	15,200
50		103	212	431	754	1,070	2,280	4,110	6,480	13,500
60		93	192	391	683	969	2,070	3,730	5,870	12,200
70		86	177	359	628	891	1,900	3,430	5,400	11,300
80		80	164	334	584	829	1,770	3,190	5,030	10,500
90		75	154	314	548	778	1,660	2,990	4,720	9,820
100		71	146	296	518	735	1,570	2,830	4,450	9,280
125		63	129	263	459	651	1,390	2,500	3,950	8,220
150		57	117	238	416	590	1,260	2,270	3,580	7,450
175		52	108	219	383	543	1,160	2,090	3,290	6,850
200		49	100	204	356	505	1,080	1,940	3,060	6,380
250		43	89	181	315	448	956	1,720	2,710	5,650
300		39	80	164	286	406	866	1,560	2,460	5,120
350		36	74	150	263	373	797	1,430	2,260	4,710
400		33	69	140	245	347	741	1,330	2,100	4,380
450		31	65	131	230	326	696	1,250	1,970	4,110
500		30	61	124	217	308	657	1,180	1,870	3,880
550		28	58	118	206	292	624	1,120	1,770	3,690
600		27	55	112	196	279	595	1,070	1,690	3,520
650		26	53	108	188	267	570	1,030	1,620	3,370
700		25	51	103	181	256	548	986	1,550	3,240
750		24	49	100	174	247	528	950	1,500	3,120
800		23	47	96	168	239	510	917	1,450	3,010
850		22	46	93	163	231	493	888	1,400	2,920
900		22	44	90	158	224	478	861	1,360	2,830
950		21	43	88	153	217	464	836	1,320	2,740
1,000		20	42	85	149	211	452	813	1,280	2,670
1,100		19	40	81	142	201	429	772	1,220	2,540
1,200		18	38	77	135	192	409	737	1,160	2,420
1,300		18	36	74	129	183	392	705	1,110	2,320
1,400		17	35	71	124	176	376	678	1,070	2,230
1,500		16	34	68	120	170	363	653	1,030	2,140
1,600		16	33	66	116	164	350	630	994	2,070
1,700		15	31	64	112	159	339	610	962	2,000
1,800		15	30	62	108	154	329	592	933	1,940
1,900		14	30	60	105	149	319	575	906	1,890
2,000		14	29	59	102	145	310	559	881	1,830

Note: All table entries are rounded to 3 significant digits.

\*Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.



**Table 12-17**  
**Semi-Rigid Copper Tubing [NFPA 54: Table 6.2(k)]**

							Gas:		Natural	
							Inlet Pressure:		2.0 psi	
							Pressure Drop:		1.5 psi	
							Specific Gravity:		0.60	
SPECIAL USE: Pipe Sizing Between Point of Delivery and the House Line Regulator. Total Load Supplied by a Single House Line Regulator Not Exceeding 150 Cubic Feet per Hour.†										
		Tube Size (in.)								
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1½	1¾	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
10		303	625	1,270	2,220	3,150	6,740	12,100	19,100	39,800
20		208	430	874	1,530	2,170	4,630	8,330	13,100	27,400
30		167	345	702	1,230	1,740	3,720	6,690	10,600	22,000
40		143	295	601	1,050	1,490	3,180	5,730	9,030	18,800
50		127	262	532	931	1,320	2,820	5,080	8,000	16,700
60		115	237	482	843	1,200	2,560	4,600	7,250	15,100
70		106	218	444	776	1,100	2,350	4,230	6,670	13,900
80		98	203	413	722	1,020	2,190	3,940	6,210	12,900
90		92	190	387	677	961	2,050	3,690	5,820	12,100
100		87	180	366	640	907	1,940	3,490	5,500	11,500
125		77	159	324	567	804	1,720	3,090	4,880	10,200
150		70	144	294	514	729	1,560	2,800	4,420	9,200
175		64	133	270	472	670	1,430	2,580	4,060	8,460
200		60	124	252	440	624	1,330	2,400	3,780	7,870
250		53	110	223	390	553	1,180	2,130	3,350	6,980
300		48	99	202	353	501	1,070	1,930	3,040	6,320
350		44	91	186	325	461	984	1,770	2,790	5,820
400		41	85	173	302	429	916	1,650	2,600	5,410
450		39	80	162	283	402	859	1,550	2,440	5,080
500		36	75	153	268	380	811	1,460	2,300	4,800
550		35	72	146	254	361	771	1,390	2,190	4,560
600		33	68	139	243	344	735	1,320	2,090	4,350
650		32	65	133	232	330	704	1,270	2,000	4,160
700		30	63	128	223	317	676	1,220	1,920	4,000
750		29	60	123	215	305	652	1,170	1,850	3,850
800		28	58	119	208	295	629	1,130	1,790	3,720
850		27	57	115	201	285	609	1,100	1,730	3,600
900		27	55	111	195	276	590	1,060	1,680	3,490
950		26	53	108	189	268	573	1,030	1,630	3,390
1,000		25	52	105	184	261	558	1,000	1,580	3,300
1,100		24	49	100	175	248	530	954	1,500	3,130
1,200		23	47	95	167	237	505	910	1,430	2,990
1,300		22	45	91	160	227	484	871	1,370	2,860
1,400		21	43	88	153	218	465	837	1,320	2,750
1,500		20	42	85	148	210	448	806	1,270	2,650
1,600		19	40	82	143	202	432	779	1,230	2,560
1,700		19	39	79	138	196	419	753	1,190	2,470
1,800		18	38	77	134	190	406	731	1,150	2,400
1,900		18	37	74	130	184	394	709	1,120	2,330
2,000		17	36	72	126	179	383	690	1,090	2,270

Note: All table entries are rounded to 3 significant digits.

<sup>\*</sup>Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

<sup>†</sup>When this table is used to size the tubing upstream of a line pressure regulator, the pipe or tubing downstream of the line pressure regulator shall be sized using a pressure drop no greater than 1 in. w.c.

**Table 12-18**  
**Semi-Rigid Copper Tubing [NFPA 54: Table 6.2(l)]**

							Gas:	Natural		
							Inlet Pressure:	5.0 psi		
							Pressure Drop:	3.5 psi		
							Specific Gravity:	0.60		
		Tube Size (in.)								
Nominal:	K & L:	¼	⅜	½	¾	1	1¼	1½	2	
	ACR:	⅜	½	¾	1	1¼	1½	—	—	
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside: *		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
10		511	1,050	2,140	3,750	5,320	11,400	20,400	32,200	67,100
20		351	724	1,470	2,580	3,650	7,800	14,000	22,200	46,100
30		282	582	1,180	2,070	2,930	6,270	11,300	17,800	37,000
40		241	498	1,010	1,770	2,510	5,360	9,660	15,200	31,700
50		214	441	898	1,570	2,230	4,750	8,560	13,500	28,100
60		194	400	813	1,420	2,020	4,310	7,750	12,200	25,500
70		178	368	748	1,310	1,860	3,960	7,130	11,200	23,400
80		166	342	696	1,220	1,730	3,690	6,640	10,500	21,800
90		156	321	653	1,140	1,620	3,460	6,230	9,820	20,400
100		147	303	617	1,080	1,530	3,270	5,880	9,270	19,300
125		130	269	547	955	1,360	2,900	5,210	8,220	17,100
150		118	243	495	866	1,230	2,620	4,720	7,450	15,500
175		109	224	456	796	1,130	2,410	4,350	6,850	14,300
200		101	208	424	741	1,050	2,250	4,040	6,370	13,300
250		90	185	376	657	932	1,990	3,580	5,650	11,800
300		81	167	340	595	844	1,800	3,250	5,120	10,700
350		75	154	313	547	777	1,660	2,990	4,710	9,810
400		69	143	291	509	722	1,540	2,780	4,380	9,120
450		65	134	273	478	678	1,450	2,610	4,110	8,560
500		62	127	258	451	640	1,370	2,460	3,880	8,090
550		58	121	245	429	608	1,300	2,340	3,690	7,680
600		56	115	234	409	580	1,240	2,230	3,520	7,330
650		53	110	224	392	556	1,190	2,140	3,370	7,020
700		51	106	215	376	534	1,140	2,050	3,240	6,740
750		49	102	207	362	514	1,100	1,980	3,120	6,490
800		48	98	200	350	497	1,060	1,910	3,010	6,270
850		46	95	194	339	481	1,030	1,850	2,910	6,070
900		45	92	188	328	466	1,000	1,790	2,820	5,880
950		43	90	182	319	452	967	1,740	2,740	5,710
1,000		42	87	177	310	440	940	1,690	2,670	5,560
1,100		40	83	169	295	418	893	1,610	2,530	5,280
1,200		38	79	161	281	399	852	1,530	2,420	5,040
1,300		37	76	154	269	382	816	1,470	2,320	4,820
1,400		35	73	148	259	367	784	1,410	2,220	4,630
1,500		34	70	143	249	353	755	1,360	2,140	4,460
1,600		33	68	138	241	341	729	1,310	2,070	4,310
1,700		32	65	133	233	330	705	1,270	2,000	4,170
1,800		31	63	129	226	320	684	1,230	1,940	4,040
1,900		30	62	125	219	311	664	1,200	1,890	3,930
2,000		29	60	122	213	302	646	1,160	1,830	3,820

Note: All table entries are rounded to 3 significant digits.

\*Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

**Table 12-19**  
**Corrugated Stainless Steel Tubing (CSST) [NFPA 54: Table 6.2(m)]**

													Gas: Natural
													Inlet Pressure: Less than 2 psi
													Pressure Drop: 0.5 in. w.c.
													Specific Gravity: 0.60
Tube Size (EHD)*													
Flow Designation:	13	15	18	19	23	25	30	31	37	46	48	60	62
Length (ft)	Capacity in Cubic Feet of Gas per Hour												
5	46	63	115	134	225	270	471	546	895	1,790	2,070	3,660	4,140
10	32	44	82	95	161	192	330	383	639	1,260	1,470	2,600	2,930
15	25	35	66	77	132	157	267	310	524	1,030	1,200	2,140	2,400
20	22	31	58	67	116	137	231	269	456	888	1,050	1,850	2,080
25	19	27	52	60	104	122	206	240	409	793	936	1,660	1,860
30	18	25	47	55	96	112	188	218	374	723	856	1,520	1,700
40	15	21	41	47	83	97	162	188	325	625	742	1,320	1,470
50	13	19	37	42	75	87	144	168	292	559	665	1,180	1,320
60	12	17	34	38	68	80	131	153	267	509	608	1,080	1,200
70	11	16	31	36	63	74	121	141	248	471	563	1,000	1,110
80	10	15	29	33	60	69	113	132	232	440	527	940	1,040
90	10	14	28	32	57	65	107	125	219	415	498	887	983
100	9	13	26	30	54	62	101	118	208	393	472	843	933
150	7	10	20	23	42	48	78	91	171	320	387	691	762
200	6	9	18	21	38	44	71	82	148	277	336	600	661
250	5	8	16	19	34	39	63	74	133	247	301	538	591
300	5	7	15	17	32	36	57	67	95	226	275	492	540

\*EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.

Notes:

(1) Table includes losses for four 90 degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings shall be increased by an equivalent length of tubing to the following equation:  $L = 1.3n$ , where  $L$  is additional length (ft) of tubing and  $n$  is the number of additional fittings and/or bends.

(2) All table entries are rounded to 3 significant digits.

**Table 12-20**  
**Corrugated Stainless Steel Tubing (CSST) [NFPA 54: Table 6.2(n)]**

													Gas: Natural
													Inlet Pressure: Less than 2 psi
													Pressure Drop: 3.0 in. w.c.
													Specific Gravity: 0.60
Tube Size (EHD)*													
Flow Designation:	13	15	18	19	23	25	30	31	37	46	48	60	62
Length (ft)	Capacity in Cubic Feet of Gas per Hour												
5	120	160	277	327	529	649	1,180	1,370	2,140	4,430	5,010	8,800	10,100
10	83	112	197	231	380	462	828	958	1,530	3,200	3,560	6,270	7,160
15	67	90	161	189	313	379	673	778	1,250	2,540	2,910	5,140	5,850
20	57	78	140	164	273	329	580	672	1,090	2,200	2,530	4,460	5,070
25	51	69	125	147	245	295	518	599	978	1,960	2,270	4,000	4,540
30	46	63	115	134	225	270	471	546	895	1,790	2,070	3,660	4,140
40	39	54	100	116	196	234	407	471	778	1,550	1,800	3,180	3,590
50	35	48	89	104	176	210	363	421	698	1,380	1,610	2,850	3,210
60	32	44	82	95	161	192	330	383	639	1,260	1,470	2,600	2,930
70	29	41	76	88	150	178	306	355	593	1,170	1,360	2,420	2,720
80	27	38	71	82	141	167	285	331	555	1,090	1,280	2,260	2,540
90	26	36	67	77	133	157	268	311	524	1,030	1,200	2,140	2,400
100	24	34	63	73	126	149	254	295	498	974	1,140	2,030	2,280
150	19	27	52	60	104	122	206	240	409	793	936	1,660	1,860
200	17	23	45	52	91	106	178	207	355	686	812	1,440	1,610
250	15	21	40	46	82	95	159	184	319	613	728	1,290	1,440
300	13	19	37	42	75	87	144	168	234	559	665	1,180	1,320

\*EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.

Notes:

(1) Table includes losses for four 90 degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings shall be increased by an equivalent length of tubing to the following equation:  $L = 1.3n$ , where  $L$  is additional length (ft) of tubing and  $n$  is the number of additional fittings and/or bends.

(2) All table entries are rounded to 3 significant digits.



**Table 12-21**  
**Corrugated Stainless Steel Tubing (CSST) [NFPA 54: Table 6.2(o)]**

												Gas:	Natural
												Inlet Pressure:	Less than 2 psi
												Pressure Drop:	6.0 in. w.c.
												Specific Gravity:	0.60
Tube Size (EHD)*													
Flow Designation:	13	15	18	19	23	25	30	31	37	46	48	60	62
Length (ft)	Capacity in Cubic Feet of Gas per Hour												
5	173	229	389	461	737	911	1,690	1,950	3,000	6,280	7,050	12,400	14,260
10	120	160	277	327	529	649	1,180	1,370	2,140	4,430	5,010	8,800	10,100
15	96	130	227	267	436	532	960	1,110	1,760	3,610	4,100	7,210	8,260
20	83	112	197	231	380	462	828	958	1,530	3,120	3,560	6,270	7,160
25	74	99	176	207	342	414	739	855	1,370	2,790	3,190	5,620	6,400
30	67	90	161	189	313	379	673	778	1,250	2,540	2,910	5,140	5,850
40	57	78	140	164	273	329	580	672	1,090	2,200	2,530	4,460	5,070
50	51	69	125	147	245	295	518	599	978	1,960	2,270	4,000	4,540
60	46	63	115	134	225	270	471	546	895	1,790	2,070	3,660	4,140
70	42	58	106	124	209	250	435	505	830	1,660	1,920	3,390	3,840
80	39	54	100	116	196	234	407	471	778	1,550	1,800	3,180	3,590
90	37	51	94	109	185	221	383	444	735	1,460	1,700	3,000	3,390
100	35	48	89	104	176	210	363	421	698	1,380	1,610	2,850	3,210
150	28	39	73	85	145	172	294	342	573	1,130	1,320	2,340	2,630
200	24	34	63	73	126	149	254	295	498	974	1,140	2,030	2,280
250	21	30	57	66	114	134	226	263	447	870	1,020	1,820	2,040
300	19	27	52	60	104	122	206	240	409	793	936	1,660	1,860

\*EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.

Notes:

(1) Table includes losses for four 90-degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings shall be increased by an equivalent length of tubing to the following equation:  $L = 1.3n$ , where  $L$  is additional length (ft) of tubing and  $n$  is the number of additional fittings and/or bends.

(2) All table entries are rounded to 3 significant digits.

**Table 12-22**  
**Corrugated Stainless Steel Tubing (CSST) [NFPA 54: Table 6.2(p)]**

												Gas:	Natural
												Inlet Pressure:	2.0 psi
												Pressure Drop:	1.0 psi
												Specific Gravity:	0.60
Tube Size (EHD)*													
Flow Designation:	13	15	18	19	23	25	30	31	37	46	48	60	62
Length (ft)	Capacity in Cubic Feet of Gas per Hour												
10	270	353	587	700	1,100	1,370	2,590	2,990	4,510	9,600	10,700	18,600	21,600
25	166	220	374	444	709	876	1,620	1,870	2,890	6,040	6,780	11,900	13,700
30	151	200	342	405	650	801	1,480	1,700	2,640	5,510	6,200	10,900	12,500
40	129	172	297	351	567	696	1,270	1,470	2,300	4,760	5,380	9,440	10,900
50	115	154	266	314	510	624	1,140	1,310	2,060	4,260	4,820	8,470	9,720
75	93	124	218	257	420	512	922	1,070	1,690	3,470	3,950	6,940	7,940
80	89	120	211	249	407	496	892	1,030	1,640	3,360	3,820	6,730	7,690
100	79	107	189	222	366	445	795	920	1,470	3,000	3,420	6,030	6,880
150	64	87	155	182	302	364	646	748	1,210	2,440	2,800	4,940	5,620
200	55	75	135	157	263	317	557	645	1,050	2,110	2,430	4,290	4,870
250	49	67	121	141	236	284	497	576	941	1,890	2,180	3,850	4,360
300	44	61	110	129	217	260	453	525	862	1,720	1,990	3,520	3,980
400	38	52	96	111	189	225	390	453	749	1,490	1,730	3,060	3,450
500	34	46	86	100	170	202	348	404	552	1,330	1,550	2,740	3,090

\*EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.

Notes:

(1) Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds  $\frac{3}{4}$  psi, do not use this table. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drops across a regulator may vary with flow rate.

(2) CAUTION: Capacities shown in table may exceed maximum capacity for a selected regulator. Consult with regulator or tubing manufacturer for guidance.

(3) Table includes losses for four 90-degree bends and two end fittings. Tubing runs with larger number of bends and/or fittings shall be increased by an equivalent length of tubing according to the following equation:  $L = 1.3n$ , where  $L$  is additional length (ft) of tubing and  $n$  is the number of additional fittings and/or bends.

(4) All table entries are rounded to 3 significant digits.



**Table 12-23**  
**Corrugated Stainless Steel Tubing (CSST) [NFPA 54: Table 6.2(q)]**

											Gas: Natural			
											Inlet Pressure:		5.0 psi	
											Pressure Drop:		3.5 psi	
											Specific Gravity:		0.60	
	Tube Size (EHD)*													
Flow Designation:	13	15	18	19	23	30	31	37	46	48	60	62		
Length (ft)	Capacity in Cubic Feet of Gas per Hour													
10	523	674	1,080	1,300	2,000	2,530	4,920	5,660	8,300	18,100	19,800	34,400	40,400	
25	322	420	691	827	1,290	1,620	3,080	3,540	5,310	11,400	12,600	22,000	25,600	
30	292	382	632	755	1,180	1,480	2,800	3,230	4,860	10,400	11,500	20,100	23,400	
40	251	329	549	654	1,030	1,280	2,420	2,790	4,230	8,970	10,000	17,400	20,200	
50	223	293	492	586	926	1,150	2,160	2,490	3,790	8,020	8,930	15,600	18,100	
75	180	238	403	479	763	944	1,750	2,020	3,110	6,530	7,320	12,800	14,800	
80	174	230	391	463	740	915	1,690	1,960	3,020	6,320	7,090	12,400	14,300	
100	154	205	350	415	665	820	1,510	1,740	2,710	5,650	6,350	11,100	12,800	
150	124	166	287	339	548	672	1,230	1,420	2,220	4,600	5,200	9,130	10,500	
200	107	143	249	294	478	584	1,060	1,220	1,930	3,980	4,510	7,930	9,090	
250	95	128	223	263	430	524	945	1,090	1,730	3,550	4,040	7,110	8,140	
300	86	116	204	240	394	479	860	995	1,590	3,240	3,690	6,500	7,430	
400	74	100	177	208	343	416	742	858	1,380	2,800	3,210	5,650	6,440	
500	66	89	159	186	309	373	662	766	1,040	2,500	2,870	5,060	5,760	

\*EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.

**Notes:**

(1) Table does not include effect of pressure drop across line regulator. Where regulator loss exceeds 1 psi, do not use this table. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drop across regulator may vary with the flow rate.

(2) CAUTION: Capacities shown in table may exceed maximum capacity of selected regulator. Consult with tubing manufacturer for guidance.

(3) Table includes losses for four 90-degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings shall be increased by an equivalent length of tubing to the following equation:  $L = 1.3n$ , where  $L$  is additional length (ft) of tubing and  $n$  is the number of additional fittings and/or bends.

(4) All table entries are rounded to 3 significant digits.

**Table 12-24**  
**Polyethylene Plastic Pipe [NFPA 54: Table 6.2(r)]**

				Gas:	Natural	
				Inlet Pressure:	Less than 2 psi	
				Pressure Drop:	0.3 in. w.c.	
				Specific Gravity:	0.60	
	Pipe Size (in.)					
Nominal OD:	½	¾	1	1¼	1½	2
Designation:	SDR 9.33	SDR 11.0	SDR 11.00	SDR 10.00	SDR 11.00	SDR 11.00
Actual ID:	0.660	0.860	1.077	1.328	1.554	1.943
Length (ft)	Capacity in Cubic Feet of Gas per Hour					
10	153	305	551	955	1,440	2,590
20	105	210	379	656	991	1,780
30	84	169	304	527	796	1,430
40	72	144	260	451	681	1,220
50	64	128	231	400	604	1,080
60	58	116	209	362	547	983
70	53	107	192	333	503	904
80	50	99	179	310	468	841
90	46	93	168	291	439	789
100	44	88	159	275	415	745
125	39	78	141	243	368	661
150	35	71	127	221	333	598
175	32	65	117	203	306	551
200	30	60	109	189	285	512
250	27	54	97	167	253	454
300	24	48	88	152	229	411
350	22	45	81	139	211	378
400	21	42	75	130	196	352
450	19	39	70	122	184	330
500	18	37	66	115	174	312

Note: All table entries are rounded to 3 significant digits.

**Table 12-25**  
**Polyethylene Plastic Pipe [NFPA 54: Table 6.2(s)]**

			Gas:		Natural	
			Inlet Pressure:		Less than 2 psi	
			Pressure Drop:		0.5 in. w.c.	
			Specific Gravity:		0.60	
	Pipe Size (in.)					
Nominal OD:	½	¾	1	1¼	1½	2
Designation:	SDR 9.33	SDR 11.0	SDR 11.00	SDR 10.00	SDR 11.00	SDR 11.00
Actual ID:	0.660	0.860	1.077	1.328	1.554	1.943
Length (ft)	Capacity in Cubic Feet of Gas per Hour					
10	201	403	726	1,260	1,900	3,410
20	138	277	499	865	1,310	2,350
30	111	222	401	695	1,050	1,880
40	95	190	343	594	898	1,610
50	84	169	304	527	796	1,430
60	76	153	276	477	721	1,300
70	70	140	254	439	663	1,190
80	65	131	236	409	617	1,110
90	61	123	221	383	579	1,040
100	58	116	209	362	547	983
125	51	103	185	321	485	871
150	46	93	168	291	439	789
175	43	86	154	268	404	726
200	40	80	144	249	376	675
250	35	71	127	221	333	598
300	32	64	115	200	302	542
350	29	59	106	184	278	499
400	27	55	99	171	258	464
450	26	51	93	160	242	435
500	24	48	88	152	229	411

Note: All table entries are rounded to 3 significant digits.

**Table 12-26**  
**Polyethylene Plastic Pipe [NFPA 54: Table 6.2(t)]**

		Gas: Natural				
		Inlet Pressure: 2.0 psi				
		Pressure Drop: 1.0 psi				
		Specific Gravity: 0.60				
		Pipe Size (in.)				
Nominal OD:	½	¾	1	1¼	1½	2
Designation:	SDR 9.33	SDR 11.0	SDR 11.00	SDR 10.00	SDR 11.00	SDR 11.00
Actual ID:	0.660	0.860	1.077	1.328	1.554	1.943
Length (ft)	Capacity in Cubic Feet of Gas per Hour					
10	1,860	3,720	6,710	11,600	17,600	31,600
20	1,280	2,560	4,610	7,990	12,100	21,700
30	1,030	2,050	3,710	6,420	9,690	17,400
40	878	1,760	3,170	5,490	8,300	14,900
50	778	1,560	2,810	4,870	7,350	13,200
60	705	1,410	2,550	4,410	6,660	12,000
70	649	1,300	2,340	4,060	6,130	11,000
80	603	1,210	2,180	3,780	5,700	10,200
90	566	1,130	2,050	3,540	5,350	9,610
100	535	1,070	1,930	3,350	5,050	9,080
125	474	949	1,710	2,970	4,480	8,050
150	429	860	1,550	2,690	4,060	7,290
175	395	791	1,430	2,470	3,730	6,710
200	368	736	1,330	2,300	3,470	6,240
250	326	652	1,180	2,040	3,080	5,530
300	295	591	1,070	1,850	2,790	5,010
350	272	544	981	1,700	2,570	4,610
400	253	506	913	1,580	2,390	4,290
450	237	475	856	1,480	2,240	4,020
500	224	448	809	1,400	2,120	3,800
550	213	426	768	1,330	2,010	3,610
600	203	406	733	1,270	1,920	3,440
650	194	389	702	1,220	1,840	3,300
700	187	374	674	1,170	1,760	3,170
750	180	360	649	1,130	1,700	3,050
800	174	348	627	1,090	1,640	2,950
850	168	336	607	1,050	1,590	2,850
900	163	326	588	1,020	1,540	2,770
950	158	317	572	990	1,500	2,690
1,000	154	308	556	963	1,450	2,610
1,100	146	293	528	915	1,380	2,480
1,200	139	279	504	873	1,320	2,370
1,300	134	267	482	836	1,260	2,270
1,400	128	257	463	803	1,210	2,180
1,500	124	247	446	773	1,170	2,100
1,600	119	239	431	747	1,130	2,030
1,700	115	231	417	723	1,090	1,960
1,800	112	224	404	701	1,060	1,900
1,900	109	218	393	680	1,030	1,850
2,000	106	212	382	662	1,000	1,800

Note: All table entries are rounded to 3 significant digits.

**Table 12-27**  
**Polyethylene Plastic Tubing [NFPA 54: Table 6.2(u)]**

	Gas: Natural	
	Inlet Pressure:	Less than 2.0 psi
	Pressure Drop:	0.3 in. w.c.
	Specific Gravity:	0.60
	Plastic Tubing Size (CTS)* (in.)	
Nominal OD:	½	¾
Designation:	SDR 7.00	SDR 11.00
Actual ID:	0.445	0.927
Length (ft)	Capacity in Cubic Feet of Gas per Hour	
10	54	372
20	37	256
30	30	205
40	26	176
50	23	156
60	21	141
70	19	130
80	18	121
90	17	113
100	16	107
125	14	95
150	13	86
175	12	79
200	11	74
225	10	69
250	NA	65
275	NA	62
300	NA	59
350	NA	54
400	NA	51
450	NA	47
500	NA	45

\*CTS = Copper tube size.

NA means a flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

**Table 12-28**  
**Polyethylene Plastic Tubing [NFPA 54: Table 6.2(v)]**

	Gas: Natural	
	Inlet Pressure:	Less than 2.0 psi
	Pressure Drop:	0.5 in. w.c.
	Specific Gravity:	0.60
	Plastic Tubing Size (CTS)* (in.)	
Nominal OD:	½	¾
Designation:	SDR 7.00	SDR 11.00
Actual ID:	0.445	0.927
Length (ft)	Capacity in Cubic Feet of Gas per Hour	
10	72	490
20	49	337
30	39	271
40	34	232
50	30	205
60	27	186
70	25	171
80	23	159
90	22	149
100	21	141
125	18	125
150	17	113
175	15	104
200	14	97
225	13	91
250	12	86
275	11	82
300	11	78
350	10	72
400	NA	67
450	NA	63
500	NA	59

\*CTS = Copper tube size.

NA means a flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.



**Table 12-29**  
**Schedule 40 Metallic Pipe [NFPA 54: Table 6.3(a)]**

						Gas:		Undiluted Propane	
						Inlet Pressure:		10.0 psi	
						Pressure Drop:		1.0 psi	
						Specific Gravity:		1.50	
SPECIAL USE: Pipe Sizing Between First Stage (High Pressure Regulator) and Second Stage (Low Pressure Regulator)									
Pipe Size (in.)									
Nominal Inside:	½	¾	1	1¼	1½	2	2½	3	4
Actual:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Thousands of Btu per Hour								
10	3,320	6,950	13,100	26,900	40,300	77,600	124,000	219,000	446,000
20	2,280	4,780	9,000	18,500	27,700	53,300	85,000	150,000	306,000
30	1,830	3,840	7,220	14,800	22,200	42,800	68,200	121,000	246,000
40	1,570	3,280	6,180	12,700	19,000	36,600	58,400	103,000	211,000
50	1,390	2,910	5,480	11,300	16,900	32,500	51,700	91,500	187,000
60	1,260	2,640	4,970	10,200	15,300	29,400	46,900	82,900	169,000
70	1,160	2,430	4,570	9,380	14,100	27,100	43,100	76,300	156,000
80	1,080	2,260	4,250	8,730	13,100	25,200	40,100	70,900	145,000
90	1,010	2,120	3,990	8,190	12,300	23,600	37,700	66,600	136,000
100	956	2,000	3,770	7,730	11,600	22,300	35,600	62,900	128,000
125	848	1,770	3,340	6,850	10,300	19,800	31,500	55,700	114,000
150	768	1,610	3,020	6,210	9,300	17,900	28,600	50,500	103,000
175	706	1,480	2,780	5,710	8,560	16,500	26,300	46,500	94,700
200	657	1,370	2,590	5,320	7,960	15,300	24,400	43,200	88,100
250	582	1,220	2,290	4,710	7,060	13,600	21,700	38,300	78,100
300	528	1,100	2,080	4,270	6,400	12,300	19,600	34,700	70,800
350	486	1,020	1,910	3,930	5,880	11,300	18,100	31,900	65,100
400	452	945	1,780	3,650	5,470	10,500	16,800	29,700	60,600
450	424	886	1,670	3,430	5,140	9,890	15,800	27,900	56,800
500	400	837	1,580	3,240	4,850	9,340	14,900	26,300	53,700
550	380	795	1,500	3,070	4,610	8,870	14,100	25,000	51,000
600	363	759	1,430	2,930	4,400	8,460	13,500	23,900	48,600
650	347	726	1,370	2,810	4,210	8,110	12,900	22,800	46,600
700	334	698	1,310	2,700	4,040	7,790	12,400	21,900	44,800
750	321	672	1,270	2,600	3,900	7,500	12,000	21,100	43,100
800	310	649	1,220	2,510	3,760	7,240	11,500	20,400	41,600
850	300	628	1,180	2,430	3,640	7,010	11,200	19,800	40,300
900	291	609	1,150	2,360	3,530	6,800	10,800	19,200	39,100
950	283	592	1,110	2,290	3,430	6,600	10,500	18,600	37,900
1,000	275	575	1,080	2,230	3,330	6,420	10,200	18,100	36,900
1,100	261	546	1,030	2,110	3,170	6,100	9,720	17,200	35,000
1,200	249	521	982	2,020	3,020	5,820	9,270	16,400	33,400
1,300	239	499	940	1,930	2,890	5,570	8,880	15,700	32,000
1,400	229	480	903	1,850	2,780	5,350	8,530	15,100	30,800
1,500	221	462	870	1,790	2,680	5,160	8,220	14,500	29,600
1,600	213	446	840	1,730	2,590	4,980	7,940	14,000	28,600
1,700	206	432	813	1,670	2,500	4,820	7,680	13,600	27,700
1,800	200	419	789	1,620	2,430	4,670	7,450	13,200	26,900
1,900	194	407	766	1,570	2,360	4,540	7,230	12,800	26,100
2,000	189	395	745	1,530	2,290	4,410	7,030	12,400	25,400

Note: All table entries are rounded to 3 significant digits.

**Table 12-30**  
**Schedule 40 Metallic Pipe [NFPA 54: Table 6.3(b)]**

						Gas:		Undiluted Propane	
						Inlet Pressure:		10.0 psi	
						Pressure Drop:		3.0 psi	
						Specific Gravity:		1.50	
SPECIAL USE: Pipe Sizing Between First Stage (High Pressure Regulator) and Second Stage (Low Pressure Regulator)									
Pipe Size (in.)									
Nominal Inside:	½	¾	1	1¼	1½	2	2½	3	4
Actual:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Thousands of Btu per Hour								
10	5,890	12,300	23,200	47,600	71,300	137,000	219,000	387,000	789,000
20	4,050	8,460	15,900	32,700	49,000	94,400	150,000	266,000	543,000
30	3,250	6,790	12,800	26,300	39,400	75,800	121,000	214,000	436,000
40	2,780	5,810	11,000	22,500	33,700	64,900	103,000	183,000	373,000
50	2,460	5,150	9,710	19,900	29,900	57,500	91,600	162,000	330,000
60	2,230	4,670	8,790	18,100	27,100	52,100	83,000	147,000	299,000
70	2,050	4,300	8,090	16,600	24,900	47,900	76,400	135,000	275,000
80	1,910	4,000	7,530	15,500	23,200	44,600	71,100	126,000	256,000
90	1,790	3,750	7,060	14,500	21,700	41,800	66,700	118,000	240,000
100	1,690	3,540	6,670	13,700	20,500	39,500	63,000	111,000	227,000
125	1,500	3,140	5,910	12,100	18,200	35,000	55,800	98,700	201,000
150	1,360	2,840	5,360	11,000	16,500	31,700	50,600	89,400	182,000
175	1,250	2,620	4,930	10,100	15,200	29,200	46,500	82,300	167,800
200	1,160	2,430	4,580	9,410	14,100	27,200	43,300	76,500	156,100
250	1,030	2,160	4,060	8,340	12,500	24,100	38,400	67,800	138,400
300	935	1,950	3,680	7,560	11,300	21,800	34,800	61,500	125,400
350	860	1,800	3,390	6,950	10,400	20,100	32,000	56,500	115,300
400	800	1,670	3,150	6,470	9,690	18,700	29,800	52,600	107,300
450	751	1,570	2,960	6,070	9,090	17,500	27,900	49,400	100,700
500	709	1,480	2,790	5,730	8,590	16,500	26,400	46,600	95,100
550	673	1,410	2,650	5,450	8,160	15,700	25,000	44,300	90,300
600	642	1,340	2,530	5,200	7,780	15,000	23,900	42,200	86,200
650	615	1,290	2,420	4,980	7,450	14,400	22,900	40,500	82,500
700	591	1,240	2,330	4,780	7,160	13,800	22,000	38,900	79,300
750	569	1,190	2,240	4,600	6,900	13,300	21,200	37,400	76,400
800	550	1,150	2,170	4,450	6,660	12,800	20,500	36,200	73,700
850	532	1,110	2,100	4,300	6,450	12,400	19,800	35,000	71,400
900	516	1,080	2,030	4,170	6,250	12,000	19,200	33,900	69,200
950	501	1,050	1,970	4,050	6,070	11,700	18,600	32,900	67,200
1,000	487	1,020	1,920	3,940	5,900	11,400	18,100	32,000	65,400
1,100	463	968	1,820	3,740	5,610	10,800	17,200	30,400	62,100
1,200	442	923	1,740	3,570	5,350	10,300	16,400	29,000	59,200
1,300	423	884	1,670	3,420	5,120	9,870	15,700	27,800	56,700
1,400	406	849	1,600	3,280	4,920	9,480	15,100	26,700	54,500
1,500	391	818	1,540	3,160	4,740	9,130	14,600	25,700	52,500
1,600	378	790	1,490	3,060	4,580	8,820	14,100	24,800	50,700
1,700	366	765	1,440	2,960	4,430	8,530	13,600	24,000	49,000
1,800	355	741	1,400	2,870	4,300	8,270	13,200	23,300	47,600
1,900	344	720	1,360	2,780	4,170	8,040	12,800	22,600	46,200
2,000	335	700	1,320	2,710	4,060	7,820	12,500	22,000	44,900

Note: All table entries are rounded to 3 significant digits.

**Table 12-31**  
**Schedule 40 Metallic Pipe [NFPA 54: Table 6.3(c)]**

						Gas:		Undiluted Propane	
						Inlet Pressure:		2.0 psi	
						Pressure Drop:		1.0 psi	
						Specific Gravity:		1.50	
	Pipe Size (in.)								
Nominal:	½	¾	1	1¼	1½	2	2½	3	4
Actual ID:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Thousands of Btu per Hour								
10	2,680	5,590	10,500	21,600	32,400	62,400	99,500	176,000	359,000
20	1,840	3,850	7,240	14,900	22,300	42,900	68,400	121,000	247,000
30	1,480	3,090	5,820	11,900	17,900	34,500	54,900	97,100	198,000
40	1,260	2,640	4,980	10,200	15,300	29,500	47,000	83,100	170,000
50	1,120	2,340	4,410	9,060	13,600	26,100	41,700	73,700	150,000
60	1,010	2,120	4,000	8,210	12,300	23,700	37,700	66,700	136,000
70	934	1,950	3,680	7,550	11,300	21,800	34,700	61,400	125,000
80	869	1,820	3,420	7,020	10,500	20,300	32,300	57,100	116,000
90	815	1,700	3,210	6,590	9,880	19,000	30,300	53,600	109,000
100	770	1,610	3,030	6,230	9,330	18,000	28,600	50,600	103,000
125	682	1,430	2,690	5,520	8,270	15,900	25,400	44,900	91,500
150	618	1,290	2,440	5,000	7,490	14,400	23,000	40,700	82,900
175	569	1,190	2,240	4,600	6,890	13,300	21,200	37,400	76,300
200	529	1,110	2,080	4,280	6,410	12,300	19,700	34,800	71,000
250	469	981	1,850	3,790	5,680	10,900	17,400	30,800	62,900
300	425	889	1,670	3,440	5,150	9,920	15,800	27,900	57,000
350	391	817	1,540	3,160	4,740	9,120	14,500	25,700	52,400
400	364	760	1,430	2,940	4,410	8,490	13,500	23,900	48,800
450	341	714	1,340	2,760	4,130	7,960	12,700	22,400	45,800
500	322	674	1,270	2,610	3,910	7,520	12,000	21,200	43,200
550	306	640	1,210	2,480	3,710	7,140	11,400	20,100	41,100
600	292	611	1,150	2,360	3,540	6,820	10,900	19,200	39,200
650	280	585	1,100	2,260	3,390	6,530	10,400	18,400	37,500
700	269	562	1,060	2,170	3,260	6,270	9,990	17,700	36,000
750	259	541	1,020	2,090	3,140	6,040	9,630	17,000	34,700
800	250	523	985	2,020	3,030	5,830	9,300	16,400	33,500
850	242	506	953	1,960	2,930	5,640	9,000	15,900	32,400
900	235	490	924	1,900	2,840	5,470	8,720	15,400	31,500
950	228	476	897	1,840	2,760	5,310	8,470	15,000	30,500
1,000	222	463	873	1,790	2,680	5,170	8,240	14,600	29,700
1,100	210	440	829	1,700	2,550	4,910	7,830	13,800	28,200
1,200	201	420	791	1,620	2,430	4,680	7,470	13,200	26,900
1,300	192	402	757	1,550	2,330	4,490	7,150	12,600	25,800
1,400	185	386	727	1,490	2,240	4,310	6,870	12,100	24,800
1,500	178	372	701	1,440	2,160	4,150	6,620	11,700	23,900
1,600	172	359	677	1,390	2,080	4,010	6,390	11,300	23,000
1,700	166	348	655	1,340	2,010	3,880	6,180	10,900	22,300
1,800	161	337	635	1,300	1,950	3,760	6,000	10,600	21,600
1,900	157	327	617	1,270	1,900	3,650	5,820	10,300	21,000
2,000	152	318	600	1,230	1,840	3,550	5,660	10,000	20,400

Note: All table entries are rounded to 3 significant digits.



**Table 12-32**  
**Schedule 40 Metallic Pipe [NFPA 54: Table 6.3(d)]**

						Gas:	Undiluted Propane		
						Inlet Pressure:	11.0 in. w.c.		
						Pressure Drop:	0.5 in. w.c.		
						Specific Gravity:	1.50		
SPECIAL USE: Pipe Sizing Between Single or Second Stage (Low Pressure Regulator) and Appliance									
	Pipe Size (in.)								
Nominal Inside:	½	¾	1	1¼	1½	2	2½	3	4
Actual:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Thousands of Btu per Hour								
10	291	608	1,150	2,350	3,520	6,790	10,800	19,100	39,000
20	200	418	787	1,620	2,420	4,660	7,430	13,100	26,800
30	160	336	632	1,300	1,940	3,750	5,970	10,600	21,500
40	137	287	541	1,110	1,660	3,210	5,110	9,030	18,400
50	122	255	480	985	1,480	2,840	4,530	8,000	16,300
60	110	231	434	892	1,340	2,570	4,100	7,250	14,800
80	101	212	400	821	1,230	2,370	3,770	6,670	13,600
100	94	197	372	763	1,140	2,200	3,510	6,210	12,700
125	89	185	349	716	1,070	2,070	3,290	5,820	11,900
150	84	175	330	677	1,010	1,950	3,110	5,500	11,200
175	74	155	292	600	899	1,730	2,760	4,880	9,950
200	67	140	265	543	814	1,570	2,500	4,420	9,010
250	62	129	243	500	749	1,440	2,300	4,060	8,290
300	58	120	227	465	697	1,340	2,140	3,780	7,710
350	51	107	201	412	618	1,190	1,900	3,350	6,840
400	46	97	182	373	560	1,080	1,720	3,040	6,190
450	42	89	167	344	515	991	1,580	2,790	5,700
500	40	83	156	320	479	922	1,470	2,600	5,300
550	37	78	146	300	449	865	1,380	2,440	4,970
600	35	73	138	283	424	817	1,300	2,300	4,700
650	33	70	131	269	403	776	1,240	2,190	4,460
700	32	66	125	257	385	741	1,180	2,090	4,260
750	30	64	120	246	368	709	1,130	2,000	4,080
800	29	61	115	236	354	681	1,090	1,920	3,920
850	28	59	111	227	341	656	1,050	1,850	3,770
900	27	57	107	220	329	634	1,010	1,790	3,640
950	26	55	104	213	319	613	978	1,730	3,530
1,000	25	53	100	206	309	595	948	1,680	3,420
1,100	25	52	97	200	300	578	921	1,630	3,320
1,200	24	50	95	195	292	562	895	1,580	3,230
1,300	23	48	90	185	277	534	850	1,500	3,070
1,400	22	46	86	176	264	509	811	1,430	2,930
1,500	21	44	82	169	253	487	777	1,370	2,800
1,600	20	42	79	162	243	468	746	1,320	2,690
1,700	19	40	76	156	234	451	719	1,270	2,590
1,800	19	39	74	151	226	436	694	1,230	2,500
1,900	18	38	71	146	219	422	672	1,190	2,420
2,000	18	37	69	142	212	409	652	1,150	2,350

Note: All table entries are rounded to 3 significant digits.

**Table 12-33**  
**Semi-Rigid Copper Tubing [NFPA 54: Table 6.3(e)]**

							Gas:	Undiluted Propane		
							Inlet Pressure:	10.0 psi		
							Pressure Drop:	1.0 psi		
							Specific Gravity:	1.50		
SPECIAL USE: Tube Sizing Between First Stage (High Pressure Regulator) and Second Stage (Low Pressure Regulator)										
Tube Size (in.)										
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅝	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside: *		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Thousands of Btu per Hour								
10	513	1,060	2,150	3,760	5,330	11,400	20,500	32,300	67,400	
20	352	727	1,480	2,580	3,670	7,830	14,100	22,200	46,300	
30	283	584	1,190	2,080	2,940	6,290	11,300	17,900	37,200	
40	242	500	1,020	1,780	2,520	5,380	9,690	15,300	31,800	
50	215	443	901	1,570	2,230	4,770	8,590	13,500	28,200	
60	194	401	816	1,430	2,020	4,320	7,780	12,300	25,600	
70	179	369	751	1,310	1,860	3,980	7,160	11,300	23,500	
80	166	343	699	1,220	1,730	3,700	6,660	10,500	21,900	
90	156	322	655	1,150	1,630	3,470	6,250	9,850	20,500	
100	147	304	619	1,080	1,540	3,280	5,900	9,310	19,400	
125	131	270	549	959	1,360	2,910	5,230	8,250	17,200	
150	118	244	497	869	1,230	2,630	4,740	7,470	15,600	
175	109	225	457	799	1,130	2,420	4,360	6,880	14,300	
200	101	209	426	744	1,060	2,250	4,060	6,400	13,300	
250	90	185	377	659	935	2,000	3,600	5,670	11,800	
300	81	168	342	597	847	1,810	3,260	5,140	10,700	
350	75	155	314	549	779	1,660	3,000	4,730	9,840	
400	70	144	292	511	725	1,550	2,790	4,400	9,160	
450	65	135	274	480	680	1,450	2,620	4,130	8,590	
500	62	127	259	453	643	1,370	2,470	3,900	8,120	
550	59	121	246	430	610	1,300	2,350	3,700	7,710	
600	56	115	235	410	582	1,240	2,240	3,530	7,350	
650	54	111	225	393	558	1,190	2,140	3,380	7,040	
700	51	106	216	378	536	1,140	2,060	3,250	6,770	
750	50	102	208	364	516	1,100	1,980	3,130	6,520	
800	48	99	201	351	498	1,060	1,920	3,020	6,290	
850	46	96	195	340	482	1,030	1,850	2,920	6,090	
900	45	93	189	330	468	1,000	1,800	2,840	5,910	
950	44	90	183	320	454	970	1,750	2,750	5,730	
1,000	42	88	178	311	442	944	1,700	2,680	5,580	
1,100	40	83	169	296	420	896	1,610	2,540	5,300	
1,200	38	79	161	282	400	855	1,540	2,430	5,050	
1,300	37	76	155	270	383	819	1,470	2,320	4,840	
1,400	35	73	148	260	368	787	1,420	2,230	4,650	
1,500	34	70	143	250	355	758	1,360	2,150	4,480	
1,600	33	68	138	241	343	732	1,320	2,080	4,330	
1,700	32	66	134	234	331	708	1,270	2,010	4,190	
1,800	31	64	130	227	321	687	1,240	1,950	4,060	
1,900	30	62	126	220	312	667	1,200	1,890	3,940	
2,000	29	60	122	214	304	648	1,170	1,840	3,830	

Note: All table entries are rounded to 3 significant digits.

\*Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

**Table 12-34**  
**Semi-Rigid Copper Tubing [NFPA 54: Table 6.3(f)]**

							Gas:	Undiluted Propane		
							Inlet Pressure:	11.0 in. w.c.		
							Pressure Drop:	0.5 in. w.c.		
							Specific Gravity:	1.50		
SPECIAL USE: Tube Sizing Between Single or Second Stage (Low Pressure Regulator) and Appliance										
Tube Size (in.)										
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅝	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside: <sup>a</sup>		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Thousands of Btu per Hour								
10	45	93	188	329	467	997	1,800	2,830	5,890	
20	31	64	129	226	321	685	1,230	1,950	4,050	
30	25	51	104	182	258	550	991	1,560	3,250	
40	21	44	89	155	220	471	848	1,340	2,780	
50	19	39	79	138	195	417	752	1,180	2,470	
60	17	35	71	125	177	378	681	1,070	2,240	
70	16	32	66	115	163	348	626	988	2,060	
80	15	30	61	107	152	324	583	919	1,910	
90	14	28	57	100	142	304	547	862	1,800	
100	13	27	54	95	134	287	517	814	1,700	
125	11	24	48	84	119	254	458	722	1,500	
150	10	21	44	76	108	230	415	654	1,360	
175	NA	20	40	70	99	212	382	602	1,250	
200	NA	18	37	65	92	197	355	560	1,170	
250	NA	16	33	58	82	175	315	496	1,030	
300	NA	15	30	52	74	158	285	449	936	
350	NA	14	28	48	68	146	262	414	861	
400	NA	13	26	45	63	136	244	385	801	
450	NA	12	24	42	60	127	229	361	752	
500	NA	11	23	40	56	120	216	341	710	
550	NA	11	22	38	53	114	205	324	674	
600	NA	10	21	36	51	109	196	309	643	
650	NA	NA	20	34	49	104	188	296	616	
700	NA	NA	19	33	47	100	180	284	592	
750	NA	NA	18	32	45	96	174	274	570	
800	NA	NA	18	31	44	93	168	264	551	
850	NA	NA	17	30	42	90	162	256	533	
900	NA	NA	17	29	41	87	157	248	517	
950	NA	NA	16	28	40	85	153	241	502	
1,000	NA	NA	16	27	39	83	149	234	488	
1,100	NA	NA	15	26	37	78	141	223	464	
1,200	NA	NA	14	25	35	75	135	212	442	
1,300	NA	NA	14	24	34	72	129	203	423	
1,400	NA	NA	13	23	32	69	124	195	407	
1,500	NA	NA	13	22	31	66	119	188	392	
1,600	NA	NA	12	21	30	64	115	182	378	
1,700	NA	NA	12	20	29	62	112	176	366	
1,800	NA	NA	11	20	28	60	108	170	355	
1,900	NA	NA	11	19	27	58	105	166	345	
2,000	NA	NA	11	19	27	57	102	161	335	

NA means a flow of less than 10,000 Btu/hr.

Note: All table entries are rounded to 3 significant digits.

<sup>a</sup>Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.



**Table 12-35**  
**Semi-Rigid Copper Tubing [NFPA 54: Table 6.3(g)]**

							Gas:		Undiluted Propane	
							Inlet Pressure:		2.0 psi	
							Pressure Drop:		1.0 psi	
							Specific Gravity:		1.50	
Nominal:	Tube Size (in.)									
	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1½	1¾	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Thousands of Btu per Hour								
10		413	852	1,730	3,030	4,300	9,170	16,500	26,000	54,200
20		284	585	1,190	2,080	2,950	6,310	11,400	17,900	37,300
30		228	470	956	1,670	2,370	5,060	9,120	14,400	29,900
40		195	402	818	1,430	2,030	4,330	7,800	12,300	25,600
50		173	356	725	1,270	1,800	3,840	6,920	10,900	22,700
60		157	323	657	1,150	1,630	3,480	6,270	9,880	20,600
70		144	297	605	1,060	1,500	3,200	5,760	9,090	18,900
80		134	276	562	983	1,390	2,980	5,360	8,450	17,600
90		126	259	528	922	1,310	2,790	5,030	7,930	16,500
100		119	245	498	871	1,240	2,640	4,750	7,490	15,600
125		105	217	442	772	1,100	2,340	4,210	6,640	13,800
150		95	197	400	700	992	2,120	3,820	6,020	12,500
175		88	181	368	644	913	1,950	3,510	5,540	11,500
200		82	168	343	599	849	1,810	3,270	5,150	10,700
250		72	149	304	531	753	1,610	2,900	4,560	9,510
300		66	135	275	481	682	1,460	2,620	4,140	8,610
350		60	124	253	442	628	1,340	2,410	3,800	7,920
400		56	116	235	411	584	1,250	2,250	3,540	7,370
450		53	109	221	386	548	1,170	2,110	3,320	6,920
500		50	103	209	365	517	1,110	1,990	3,140	6,530
550		47	97	198	346	491	1,050	1,890	2,980	6,210
600		45	93	189	330	469	1,000	1,800	2,840	5,920
650		43	89	181	316	449	959	1,730	2,720	5,670
700		41	86	174	304	431	921	1,660	2,620	5,450
750		40	82	168	293	415	888	1,600	2,520	5,250
800		39	80	162	283	401	857	1,540	2,430	5,070
850		37	77	157	274	388	829	1,490	2,350	4,900
900		36	75	152	265	376	804	1,450	2,280	4,750
950		35	72	147	258	366	781	1,410	2,220	4,620
1,000		34	71	143	251	356	760	1,370	2,160	4,490
1,100		32	67	136	238	338	721	1,300	2,050	4,270
1,200		31	64	130	227	322	688	1,240	1,950	4,070
1,300		30	61	124	217	309	659	1,190	1,870	3,900
1,400		28	59	120	209	296	633	1,140	1,800	3,740
1,500		27	57	115	201	286	610	1,100	1,730	3,610
1,600		26	55	111	194	276	589	1,060	1,670	3,480
1,700		26	53	108	188	267	570	1,030	1,620	3,370
1,800		25	51	104	182	259	553	1,000	1,570	3,270
1,900		24	50	101	177	251	537	966	1,520	3,170
2,000		23	48	99	172	244	522	940	1,480	3,090

Note: All table entries are rounded to 3 significant digits.

\*Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.



**Table 12-36**  
**Corrugated Stainless Steel Tubing (CSST) [NFPA 54: Table 6.3(h)]**

													Gas: Undiluted Propane
													Inlet Pressure: 11.0 in. w.c.
													Pressure Drop: 0.5 in. w.c.
													Specific Gravity: 1.50
Tube Size (EHD)*													
Flow Designation:	13	15	18	19	23	25	30	31	37	46	48	60	62
Length (ft)	Capacity in Thousands of Btu per Hour												
5	72	99	181	211	355	426	744	863	1,420	2,830	3,270	5,780	6,550
10	50	69	129	150	254	303	521	605	971	1,990	2,320	4,110	4,640
15	39	55	104	121	208	248	422	490	775	1,620	1,900	3,370	3,790
20	34	49	91	106	183	216	365	425	661	1,400	1,650	2,930	3,290
25	30	42	82	94	164	192	325	379	583	1,250	1,480	2,630	2,940
30	28	39	74	87	151	177	297	344	528	1,140	1,350	2,400	2,680
40	23	33	64	74	131	153	256	297	449	988	1,170	2,090	2,330
50	20	30	58	66	118	137	227	265	397	884	1,050	1,870	2,080
60	19	26	53	60	107	126	207	241	359	805	961	1,710	1,900
70	17	25	49	57	99	117	191	222	330	745	890	1,590	1,760
80	15	23	45	52	94	109	178	208	307	696	833	1,490	1,650
90	15	22	44	50	90	102	169	197	286	656	787	1,400	1,550
100	14	20	41	47	85	98	159	186	270	621	746	1,330	1,480
150	11	15	31	36	66	75	123	143	217	506	611	1,090	1,210
200	9	14	28	33	60	69	112	129	183	438	531	948	1,050
250	8	12	25	30	53	61	99	117	163	390	476	850	934
300	8	11	23	26	50	57	90	107	147	357	434	777	854

\*EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.

Notes:

(1) Table includes losses for four 90 degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings shall be increased by an equivalent length of tubing to the following equation:  $L = 1.3n$ , where  $L$  is additional length (ft) of tubing and  $n$  is the number of additional fittings and/or bends.

(2) All table entries are rounded to 3 significant digits.

**Table 12-37**  
**Corrugated Stainless Steel Tubing (CSST) [NFPA 54: Table 6.3(i)]**

													Gas: Undiluted Propane
													Inlet Pressure: 2.0 psi
													Pressure Drop: 1.0 psi
													Specific Gravity: 1.50
Tube Size (EHD)*													
Flow Designation:	13	15	18	19	23	25	30	31	37	46	48	60	62
Length (ft)	Capacity in Thousands of Btu per Hour												
10	426	558	927	1,110	1,740	2,170	4,100	4,720	7,130	15,200	16,800	29,400	34,200
25	262	347	591	701	1,120	1,380	2,560	2,950	4,560	9,550	10,700	18,800	21,700
30	238	316	540	640	1,030	1,270	2,330	2,690	4,180	8,710	9,790	17,200	19,800
40	203	271	469	554	896	1,100	2,010	2,320	3,630	7,530	8,500	14,900	17,200
50	181	243	420	496	806	986	1,790	2,070	3,260	6,730	7,610	13,400	15,400
75	147	196	344	406	663	809	1,460	1,690	2,680	5,480	6,230	11,000	12,600
80	140	189	333	393	643	768	1,410	1,630	2,590	5,300	6,040	10,600	12,200
100	124	169	298	350	578	703	1,260	1,450	2,330	4,740	5,410	9,530	10,900
150	101	137	245	287	477	575	1,020	1,180	1,910	3,860	4,430	7,810	8,890
200	86	118	213	248	415	501	880	1,020	1,660	3,340	3,840	6,780	7,710
250	77	105	191	222	373	448	785	910	1,490	2,980	3,440	6,080	6,900
300	69	96	173	203	343	411	716	829	1,360	2,720	3,150	5,560	6,300
400	60	82	151	175	298	355	616	716	1,160	2,350	2,730	4,830	5,460
500	53	72	135	158	268	319	550	638	1,030	2,100	2,450	4,330	4,880

\*EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.

Notes:

(1) Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds ½ psi (based on 13 in. w.c. outlet pressure), do not use this table. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drops across a regulator may vary with flow rate.

(2) CAUTION: Capacities shown in table may exceed maximum capacity for a selected regulator. Consult with regulator or tubing manufacturer for guidance.

(3) Table includes losses for four 90 degree bends and two end fittings. Tubing runs with larger number of bends and/or fittings shall be increased by an equivalent length of tubing according to the following equation:  $L = 1.3n$ , where  $L$  is additional length (ft) of tubing and  $n$  is the number of additional fittings and/or bends.

(4) All table entries are rounded to 3 significant digits.

**Table 12-38**  
**Corrugated Stainless Steel Tubing (CSST) [NFPA 54: Table 6.3(j)]**

											Gas:		Undiluted Propane	
											Inlet Pressure:		5.0 psi	
											Pressure Drop:		3.5 psi	
											Specific Gravity:		1.50	
Tube Size (EHD)®														
Flow Designation:	13	15	18	19	23	25	30	31	37	46	48	60	62	
Length (ft)	Capacity in Thousands of Btu per Hour													
10	826	1,070	1,710	2,060	3,150	4,000	7,830	8,950	13,100	28,600	31,200	54,400	63,800	
25	509	664	1,090	1,310	2,040	2,550	4,860	5,600	8,400	18,000	19,900	34,700	40,400	
30	461	603	999	1,190	1,870	2,340	4,430	5,100	7,680	16,400	18,200	31,700	36,900	
40	396	520	867	1,030	1,630	2,030	3,820	4,400	6,680	14,200	15,800	27,600	32,000	
50	352	463	777	926	1,460	1,820	3,410	3,930	5,990	12,700	14,100	24,700	28,600	
75	284	376	637	757	1,210	1,490	2,770	3,190	4,920	10,300	11,600	20,300	23,400	
80	275	363	618	731	1,170	1,450	2,680	3,090	4,770	9,990	11,200	19,600	22,700	
100	243	324	553	656	1,050	1,300	2,390	2,760	4,280	8,930	10,000	17,600	20,300	
150	196	262	453	535	866	1,060	1,940	2,240	3,510	7,270	8,210	14,400	16,600	
200	169	226	393	464	755	923	1,680	1,930	3,050	6,290	7,130	12,500	14,400	
250	150	202	352	415	679	828	1,490	1,730	2,740	5,620	6,390	11,200	12,900	
300	136	183	322	379	622	757	1,360	1,570	2,510	5,120	5,840	10,300	11,700	
400	117	158	279	328	542	657	1,170	1,360	2,180	4,430	5,070	8,920	10,200	
500	104	140	251	294	488	589	1,050	1,210	1,950	3,960	4,540	8,000	9,110	

**Table 12-40**  
**Polyethylene Plastic Pipe [NFPA 54: Table 6.3(I)]**

					Gas:	Undiluted Propane
					Inlet Pressure:	2.0 psi
					Pressure Drop:	1.0 psi
					Specific Gravity:	1.50
Pipe Size (in.)						
Nominal OD:	½	¾	1	1¼	1½	2
Designation:	SDR 9.33	SDR 11.0	SDR 11.00	SDR 10.00	SDR 11.00	SDR 11.00
Actual ID:	0.660	0.860	1.077	1.328	1.554	1.943
Length (ft)	Capacity in Thousands of Btu per Hour					
10	3,130	6,260	11,300	19,600	29,500	53,100
20	2,150	4,300	7,760	13,400	20,300	36,500
30	1,730	3,450	6,230	10,800	16,300	29,300
40	1,480	2,960	5,330	9,240	14,000	25,100
50	1,310	2,620	4,730	8,190	12,400	22,200
60	1,190	2,370	4,280	7,420	11,200	20,100
70	1,090	2,180	3,940	6,830	10,300	18,500
80	1,010	2,030	3,670	6,350	9,590	17,200
90	952	1,910	3,440	5,960	9,000	16,200
100	899	1,800	3,250	5,630	8,500	15,300
125	797	1,600	2,880	4,990	7,530	13,500
150	722	1,450	2,610	4,520	6,830	12,300
175	664	1,330	2,400	4,160	6,280	11,300
200	618	1,240	2,230	3,870	5,840	10,500
250	548	1,100	1,980	3,430	5,180	9,300
300	496	994	1,790	3,110	4,690	8,430
350	457	914	1,650	2,860	4,320	7,760
400	425	851	1,530	2,660	4,020	7,220
450	399	798	1,440	2,500	3,770	6,770
500	377	754	1,360	2,360	3,560	6,390
550	358	716	1,290	2,240	3,380	6,070
600	341	683	1,230	2,140	3,220	5,790
650	327	654	1,180	2,040	3,090	5,550
700	314	628	1,130	1,960	2,970	5,330
750	302	605	1,090	1,890	2,860	5,140
800	292	585	1,050	1,830	2,760	4,960
850	283	566	1,020	1,770	2,670	4,800
900	274	549	990	1,710	2,590	4,650
950	266	533	961	1,670	2,520	4,520
1,000	259	518	935	1,620	2,450	4,400
1,100	246	492	888	1,540	2,320	4,170
1,200	234	470	847	1,470	2,220	3,980
1,300	225	450	811	1,410	2,120	3,810
1,400	216	432	779	1,350	2,040	3,660
1,500	208	416	751	1,300	1,960	3,530
1,600	201	402	725	1,260	1,900	3,410
1,700	194	389	702	1,220	1,840	3,300
1,800	188	377	680	1,180	1,780	3,200
1,900	183	366	661	1,140	1,730	3,110
2,000	178	356	643	1,110	1,680	3,020

Note: All table entries are rounded to 3 significant digits.

**Table 12-41**  
**Polyethylene Plastic Tubing [NFPA 54: Table 6.3(m)]**

	<b>Gas: Undiluted Propane</b>	
	<b>Inlet Pressure: 11.0 in. w.c.</b>	
	<b>Pressure Drop: 0.5 in. w.c.</b>	
	<b>Specific Gravity: 1.50</b>	
	<b>Plastic Tubing Size (CTS) (in.)</b>	
<b>Nominal OD:</b>	$\frac{1}{2}$	$\frac{3}{4}$
<b>Designation:</b>	<b>SDR 7.00</b>	<b>SDR 11.00</b>
<b>Actual ID:</b>	<b>0.445</b>	<b>0.927</b>
<b>Length (ft)</b>	<b>Capacity in Thousands of Btu per Hour</b>	
10	121	828
20	83	569
30	67	457
40	57	391
50	51	347
60	46	314
70	42	289
80	39	269
90	37	252
100	35	238
125	31	211
150	28	191
175	26	176
200	24	164
225	22	154
250	21	145
275	20	138
300	19	132
350	18	121
400	16	113
450	15	106
500	15	100

Note: All table entries are rounded to 3 significant digits.



# APPENDIX G [DWR]

## GRAYWATER SYSTEMS

### G 1 Graywater Systems (General)

(a) The provisions of this Appendix shall apply to the construction, installation, alteration and repair of graywater systems for subsurface landscape irrigation. The graywater system shall not be connected to any potable water system without an air gap (a space or other physical device which prevents backflow) and shall not result in any surfacing of the graywater. Except as otherwise provided for in this Appendix, the provisions of the Uniform Plumbing Code (U.P.C.) shall be applicable to graywater installations.

(b) The type of system shall be determined on the basis of location, soil type and ground water level and shall be designed to accept all graywater connected to the system from the building. The system shall discharge into subsurface irrigation fields and may include surge tank(s) and appurtenances, as required by the Administrative Authority.

(c) No graywater system, or part thereof, shall be located on any lot other than the lot which is the site of the building or structure which discharges the graywater; nor shall any graywater system or part thereof be located at any point having less than the minimum distances indicated in Table G-1.

(d) No permit for any graywater system shall be issued until a plot plan with appropriate data satisfactory to the Administrative Authority has been submitted and approved. When there is insufficient lot area or inappropriate soil conditions for adequate absorption of the graywater, as determined by the Administrative Authority, no graywater system shall be permitted. The Administrative Authority is a city or county.

(e) No permit shall be issued for a graywater system which would adversely impact a geologically sensitive area, as determined by the Administrative Authority.

(f) Private sewage disposal systems existing or to be constructed on the premises shall comply with Appendix K of this Code or applicable local ordinance. When abandoning underground tanks, Section 722.0 of the U.P.C. shall apply. Also, appropriate clearances from graywater systems shall be maintained as provided in Table G-1. The capacity of the private sewage disposal system, including required future areas, shall not be decreased by the existence or proposed installation of a graywater system servicing the premises.

(g) Installers of graywater systems shall provide an operation and maintenance manual, acceptable to the Administrative Authority, to the owner of each system. Graywater systems require regular or periodic maintenance.

(h) The Administrative Authority shall provide the applicant a copy of this Appendix.

### G 2 Definitions

Graywater is untreated waste water which has not come into contact with toilet waste. Graywater includes used water from bathtubs, showers, bathroom wash basins, clothes washing machines and laundry tubs or an equivalent discharge as approved by the Administrative Authority. It does not include waste water from kitchen sinks, photo lab sinks, dishwashers or laundry water from soiled diapers.

Surfacing of graywater means the ponding, running off or other release of graywater from the land surface.

### G 3 Permit

It shall be unlawful for any person to construct, install or alter, or cause to be constructed, installed or altered, any graywater system in a building or on a premises without first obtaining a permit to do such work from the Administrative Authority.

### G 4 Drawings and Specifications

The Administrative Authority may require any or all of the following information to be included with or in the plot plan before a permit is issued for a graywater system:

(a) Plot plan drawn to scale completely dimensioned, showing lot lines and structures, direction and approximate slope of surface, location of all present or proposed retaining walls, drainage channels, water supply lines, wells, paved areas and structures on the plot, number of bedrooms and plumbing fixtures in each structure, location of private sewage disposal system and 100 percent expansion area or building sewer connecting to public sewer, and location of the proposed graywater system.

(b) Details of construction necessary to ensure compliance with the requirements of this Appendix together with a full description of the complete installation, including installation methods, construction and materials as required by the Administrative Authority.

(c) A log of soil formations and ground water level as determined by test holes dug in close proximity to any proposed irrigation area, together with a statement of water absorption characteristics of the soil at the proposed site as determined by approved percolation tests. In lieu of percolation tests, the Administrative Authority may allow the use of Table G-2, an infiltration rate designated by the Administrative Authority, or an infiltration rate determined by a test approved by the Administrative Authority.

(d) A characterization of the graywater for commercial, industrial or institutional systems, based on existing records or testing.

**G 5 Inspection and Testing****(a) Inspection**

- (1) All applicable provisions of this Appendix and of Section 103.5 of the U.P.C. shall be complied with.
- (2) System components shall be properly identified as to manufacturer.
- (3) Surge tanks shall be installed on dry, level, well-compacted soil if in a drywell, or on a level, 3-inch (76 mm) concrete slab or equivalent, if above ground.
- (4) Surge tanks shall be anchored against overturning.
- (5) If the irrigation design is predicated on soil tests, the irrigation field shall be installed at the same location and depth as the tested area.
- (6) Installation shall conform with the equipment and installation methods identified in the approved plans.
- (7) Graywater stub-out plumbing may be allowed for future connection prior to the installation of irrigation lines and landscaping. Stub-out shall be permanently marked GRAYWATER STUB-OUT, DANGER—UNSAFE WATER.

**(b) Testing**

- (1) Surge tanks shall be filled with water to the overflow line prior to and during inspection. All seams and joints shall be left exposed and the tank shall remain watertight.
- (2) A flow test shall be performed through the system to the point of graywater irrigation. All lines and components shall be watertight.

**G 6 Procedure for Estimating Graywater Discharge****(a) Single Family Dwellings and Multifamily Dwellings**

The Administrative Authority may utilize the graywater discharge procedure listed below, water use records, or calculations of local daily per person interior water use:

1. The number of occupants of each dwelling unit shall be calculated as follows:

First bedroom	2 occupants
Each additional bedroom	1 occupant

2. The estimated graywater flows for each occupant shall be calculated as follows:

Showers, bathtubs and wash basins	25 GPD/occupant
Laundry	15 GPD/occupant

3. The total number of occupants shall be multiplied by the applicable estimated graywater discharge as provided above and the type of fixtures connected to the graywater system.

**(b) Commercial, Industrial and Institutional Projects**

The Administrative Authority may utilize the graywater discharge procedure listed below, water use records or other documentation to estimate graywater discharge:

1. The square footage of the building divided by the occupant load factor from U.B.C. Table 10-A equals the number of occupants.
2. The number of occupants times the flow rate per person (minus toilet water and other disallowed sources) from U.P.C. Table I-2 equals the estimated graywater discharge per day.

The graywater system shall be designed to distribute the total amount of estimated graywater discharged daily.

**G 7 Required Area of Subsurface Irrigation**

Each irrigation zone shall have a minimum effective irrigation area for the type of soil and infiltration rate to distribute all graywater produced daily, pursuant to Section G-6, without surfacing. The required irrigation area shall be based on the estimated graywater discharge, pursuant to Section G-6 of this Appendix, size of surge tank, or a method determined by the Administrative Authority.

If the mini-leachfield irrigation system is used, the required square footage shall be determined from Table G-2, or equivalent, for the type of soil found in the excavation. The area of the irrigation field shall be equal to the aggregate length of the perforated pipe sections within the irrigation zone times the width of the proposed mini-leachfield trench.

No irrigation point shall be within 5 vertical feet (1524 mm) of highest known seasonal groundwater nor where graywater may contaminate the ground water or ocean water. The applicant shall supply evidence of ground water depth to the satisfaction of the Administrative Authority.

**G 8 Determination of Irrigation Capacity**

(a) In order to determine the absorption quantities of questionable soils other than those listed in Table G-2, the proposed site may be subjected to percolation tests acceptable to the Administrative Authority or determined by the Administrative Authority.

(b) When a percolation test is required, no mini-leachfield system or subsurface drip irrigation system shall be permitted if the test shows the absorption capacity of the soil is less than 60 minutes/inch or more rapid than five minutes/inch, unless otherwise permitted by the Administrative Authority.

(c) The irrigation field size may be computed from Table G-2, or determined by the Administrative Authority or a designee of the Administrative Authority.

**G 9 Surge Tank Construction (Figure 1)**

(a) Plans for surge tanks shall be submitted to the Administrative Authority for approval. The plans shall show the data required by the Administrative Authority and may include dimensions, structural calculations, and bracing details.

(b) Surge tanks shall be constructed of solid, durable materials, not subject to excessive corrosion or decay, and shall be watertight.

(c) Surge tanks shall be vented as required by Chapter 5 of this Code and shall have a locking, gasketed access opening, or approved equivalent, to allow for inspection and cleaning.

(d) Surge tanks shall have the rated capacity permanently marked on the unit. In addition, GRAYWATER IRRIGATION SYSTEM, DANGER—UNSAFE WATER shall be permanently marked on the surge tank.

(e) Surge tanks installed above ground shall have an overflow, separate from the line connecting the tank with the irrigation fields. The overflow shall have a permanent connection to a sewer or to a septic tank, and shall be protected against sewer line backflow by a backwater valve. The overflow shall not be equipped with a shut-off valve.

(f) The overflow and drain pipes shall not be less in diameter than the inlet pipe. The vent size shall be based on the total graywater fixture units, as outlined in U.P.C. Table 7-5 or local equivalent. Unions or equally effective fittings shall be provided for all piping connected to the surge tank.

(g) Surge tanks shall be structurally designed to withstand anticipated loads. Surge tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (14.4 kN/m<sup>2</sup>) when the tank is designed for underground installation.

(h) Surge tanks may be installed below ground in a dry well on compacted soil, or buried if the tank design is approved by the Administrative Authority. The system shall be designed so that the tank overflow will gravity drain to a sanitary sewer line or septic tank. The tank must be protected against sewer line backflow by a backwater valve.

**(i) Materials**

(1) Surge tanks shall meet nationally recognized standards for nonpotable water and shall be approved by the Administrative Authority.

(2) Steel surge tanks shall be protected from corrosion, both externally and internally, by an approved coating or by other acceptable means.

**G 10 Valves and Piping (Figure 1)**

Graywater piping discharging into a surge tank or having a direct connection to a sanitary drain or sewer piping shall be downstream of an approved waterseal-type trap(s). If no

such trap(s) exists, an approved vented running trap shall be installed upstream of the connection to protect the building from any possible waste or sewer gases. Vents and venting shall meet the requirements in Chapter 9 of the U.P.C.

All graywater piping shall be marked or shall have a continuous tape marked with the words DANGER—UNSAFE WATER. All valves, including the three-way valve, shall be readily accessible and shall be approved by the Administrative Authority. A backwater valve, installed pursuant to this Appendix, shall be provided on all surge tank drain connections to the sanitary drain or sewer piping.

**G 11 Irrigation Field Construction**

The Administrative Authority may permit subsurface drip irrigation, mini-leachfield or other equivalent irrigation methods which discharge graywater in a manner which ensures that the graywater does not surface. Design standards for subsurface drip irrigation systems and mini-leachfield irrigation systems follow:

**(a) Standards for a subsurface drip irrigation system are:**

(1) Minimum 140 mesh (115 micron) filter with a capacity of 25 gallons (94.6 L) per minute, or equivalent, filtration, sized approximately to maintain the filtration rate, shall be used. The filter backwash and flush discharge shall be caught, contained and disposed of to the sewer system, septic tank or, with approval of the Administrative Authority, a separate mini-leachfield sized to accept all the backwash and flush discharge water. Filter backwash water and flush water shall not be used for any purpose. Sanitary procedures shall be followed when handling filter backwash and flush discharge or graywater.

(2) Emitters shall have a minimum flow path of 1,200 microns and shall have a coefficient of manufacturing variation (Cv) of no more than 7 percent. Irrigation system design shall be such that emitter flow variation shall not exceed " 10 percent. Emitters shall be recommended by the manufacturer for subsurface use and graywater use, and shall have demonstrated resistance root intrusion. For emitter ratings, refer to Irrigation Equipment Performance Report, Drip Emitters and Micro-Sprinklers, Center for Irrigation Technology, California State University, 5730 N. Chestnut Avenue, Fresno, California 93740-0018.

(3) Each irrigation zone shall be designed to include no less than the number of emitters specified in Table G-3, or through a procedure designated by the Administrative Authority. Minimum spacing between emitters is 14 inches (356 mm) in any direction.

(4) The system design shall provide user controls, such as valves, switches, timers and other controllers, as appropriate, to rotate the distribution of graywater between irrigation zones.



(5) All drip irrigation supply lines shall be polyethylene tubing or PVC Class 200 pipe or better and Schedule 40 fittings. All joints shall be properly solvent-cemented, inspected and pressure tested at 40 psi (276 kPa), and shown to be drip tight for five minutes, before burial. All supply lines will be buried at least 8 inches (203 mm) deep. Drip feeder lines can be poly or flexible PVC tubing and shall be covered to a minimum depth of 9 inches (229 mm).

(6) Where pressure at the discharge side of the pump exceeds 20 psi (138 kPa), a pressure-reducing valve able to maintain downstream pressure no greater than 20 psi (138 kPa) shall be installed downstream from the pump and before any emission device.

(7) Each irrigation zone shall include a flush valve/antisiphon valve to prevent back siphonage of water and soil.

(b) Standards for the mini-leachfield system are:

(1) Perforated sections shall be a minimum 3-inch (76 mm) diameter and shall be constructed of perforated high-density polyethylene pipe, perforated ABS pipe, perforated PVC pipe, or other approved materials, provided that sufficient openings are available for distribution of the graywater into the trench area. Material, construction and perforation of the piping shall be in compliance with the appropriate absorption field drainage piping standards and shall be approved by the Administrative Authority.

(2) Clean stone, gravel or similar filter material acceptable to the Administrative Authority, and varying in size between 3/4 inch (19 mm) to 2 1/2 inches (64 mm) shall be placed in the trench to the depth and grade required by this section. Perforated sections shall be laid on the filter material in an approved manner. The perforated sections shall then be covered with filter material to the minimum depth required by this section. The filter material shall then be covered with landscape filter fabric or similar porous material to prevent closure of voids with earth backfill. No earth backfill shall be placed over the filter material cover until after inspections and acceptance.

(3) Irrigation fields shall be constructed as follows:

	Minimum	Maximum
Number of drain lines per valved zone	1	—
Length of each perforated line	—	100 ft. (30840 m m)
Bottom width of trench	6 in. (152 mm)	18 in. (457 m m)
Total depth of trench	17 in. (432 mm)	18 in. (457 mm)
Spacing of lines, center-to-center	4 ft. (1219 mm)	—
Depth of earth cover of lines	9 in. (229 mm)	—
Depth of filter material cover of lines	2 in. (51 mm)	—
Depth of filter material beneath lines	3 in. (76 mm)	—
Grade of perforated lines	level	3 in./100 ft. (76 mm/30 480 mm)

## G 12 Special Provisions

(a) Other collection and distribution systems may be approved by the Administrative Authority as allowed by Section 310.0 of the U.P.C.

(b) Nothing contained in this Appendix shall be construed to prevent the Administrative Authority from requiring compliance with stricter requirements than those contained herein, where such stricter requirements are essential in maintaining safe and sanitary conditions or from prohibiting graywater systems. The prohibition of graywater systems or more restrictive standards may be adopted by the Administrative Authority by ordinance after a public hearing.

## G 13 Health and Safety

(a) Graywater may contain fecal matter as a result of bathing and/or washing of diapers and undergarments. Water containing fecal matter, if swallowed, can cause illness in a susceptible person.

(b) Graywater shall not include laundry water from soiled diapers.

(c) Graywater shall not be applied above the land surface or allowed to surface and shall not be discharged directly into or reach any storm sewer system or any water of the United States.

(d) Graywater shall not be contacted by humans, except as required to maintain the graywater treatment and distribution system.

(e) Graywater shall not be used for vegetable gardens.



**Table G-1 Location of Graywater System**

<i>Minimum Horizontal Distance From</i>	<i>Surge Tank (feet)</i>	<i>Irrigation Field (feet)</i>
	<i>x 304.8 for mm</i>	<i>x 304.8 for mm</i>
<i>Buildings or structures<sup>1</sup></i>	<i>5<sup>2</sup></i>	<i>8<sup>3</sup></i>
<i>Property line adjoining private property</i>	<i>5</i>	<i>5</i>
<i>Water supply wells<sup>4</sup></i>	<i>50</i>	<i>100</i>
<i>Streams and lakes<sup>4</sup></i>	<i>50</i>	<i>50</i>
<i>Seepage pits or cesspools</i>	<i>5</i>	<i>5</i>
<i>Disposal field and 100 percent expansion area</i>	<i>5</i>	<i>4<sup>5</sup></i>
<i>Septic tank</i>	<i>0</i>	<i>5<sup>6</sup></i>
<i>On-site domestic water service line</i>	<i>5</i>	<i>5<sup>7</sup></i>
<i>Pressure public water main</i>	<i>10</i>	<i>10<sup>8</sup></i>
<i>Water ditches</i>	<i>50</i>	<i>50</i>

**Notes:** When mini-leach fields are installed in sloping ground, the minimum horizontal distance between any part of the distribution system and ground surface shall be 15 feet (4572 mm).

<sup>1</sup>Including porches and steps, whether covered or uncovered, but does not include carports, covered walks, driveways and similar structures.

<sup>2</sup>The distance may be reduced to 0 feet for aboveground tanks if approved by the Administrative Authority.

<sup>3</sup>The distance may be reduced to 2 feet (610 mm).

<sup>4</sup>For subsurface drip irrigation systems, 2 feet (610 mm) from property line.

<sup>5</sup>Where special hazards are involved, the distance may be increased by the Administrative Authority.

<sup>6</sup>Applies to the mini-leachfield type system only. Plus 2 feet (610 mm) for each additional foot of depth in excess of 1 foot (305 mm) below the bottom of the drain line.

<sup>7</sup>Applies to mini-leachfield-type system only.

<sup>8</sup>A 2-foot (610 mm) separation is required for subsurface drip systems.

<sup>9</sup>For parallel construction or for crossings, approval by the Administrative Authority shall be required.

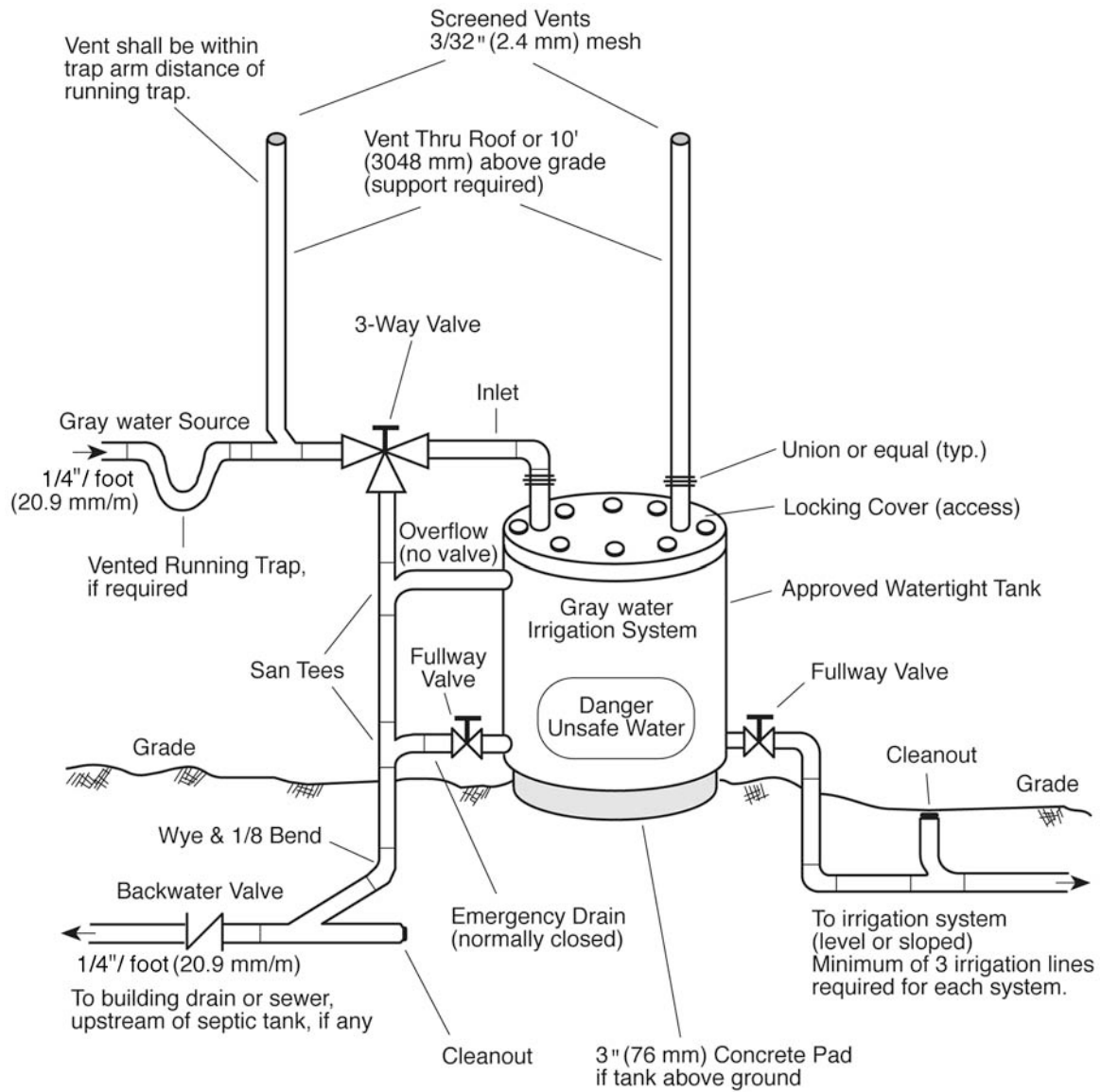
**Table G-2 Mini-Leachfield Design Criteria of Six Typical Soils**

<b>Type of Soil</b>	<b>Minimum sq. ft. of irrigation area per 100 gallons of estimated graywater discharge per day</b>	<b>Maximum absorption capacity, minutes per inch, of irrigation area for a 24-hour period</b>
1. Coarse sand or gravel	20	5
	25	12
2. Fine sand	40	18
3. Sandy loam	60	24
4. Sandy clay		
5. Clay with considerable sand or gravel	90	48
6. Clay with small amount of sand or gravel	120	60

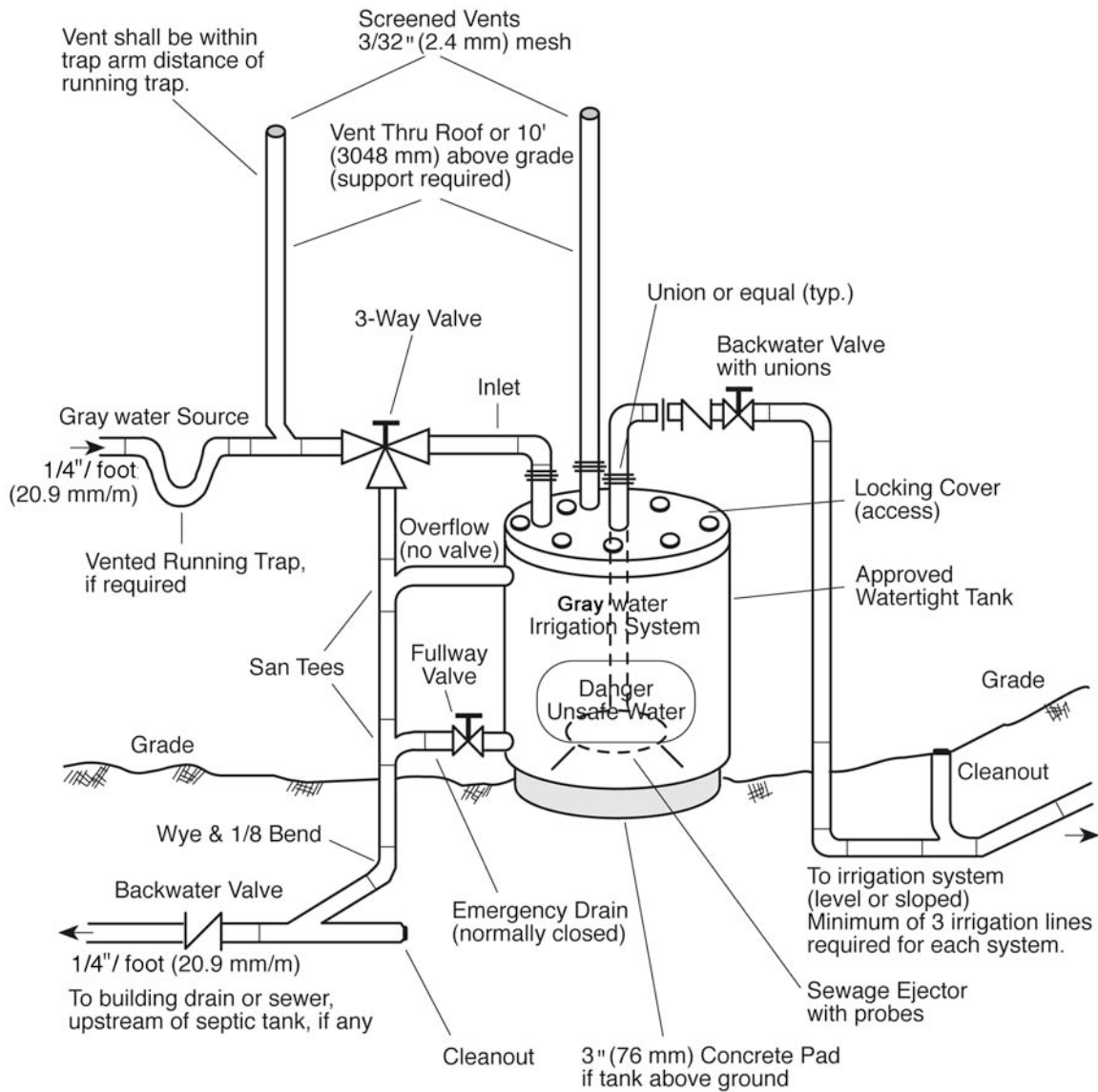
**Table G-3 Subsurface Drip Design Criteria of Six Typical Soils**

<b>Type of Soil</b>	<b>Maximum emitter discharge (gal/day)</b>	<b>Minimum number of emitters per gpd of graywater production</b>
1. Sand	1.8	0.6
2. Sandy loam	1.4	0.7
3. Loam	1.2	0.9
4. Clay loam	0.9	1.1
5. Silty clay	0.6	1.6
6. Clay	0.5	2.0

Use the daily graywater flow calculated in Section G-6 to determine the number of emitters per line.

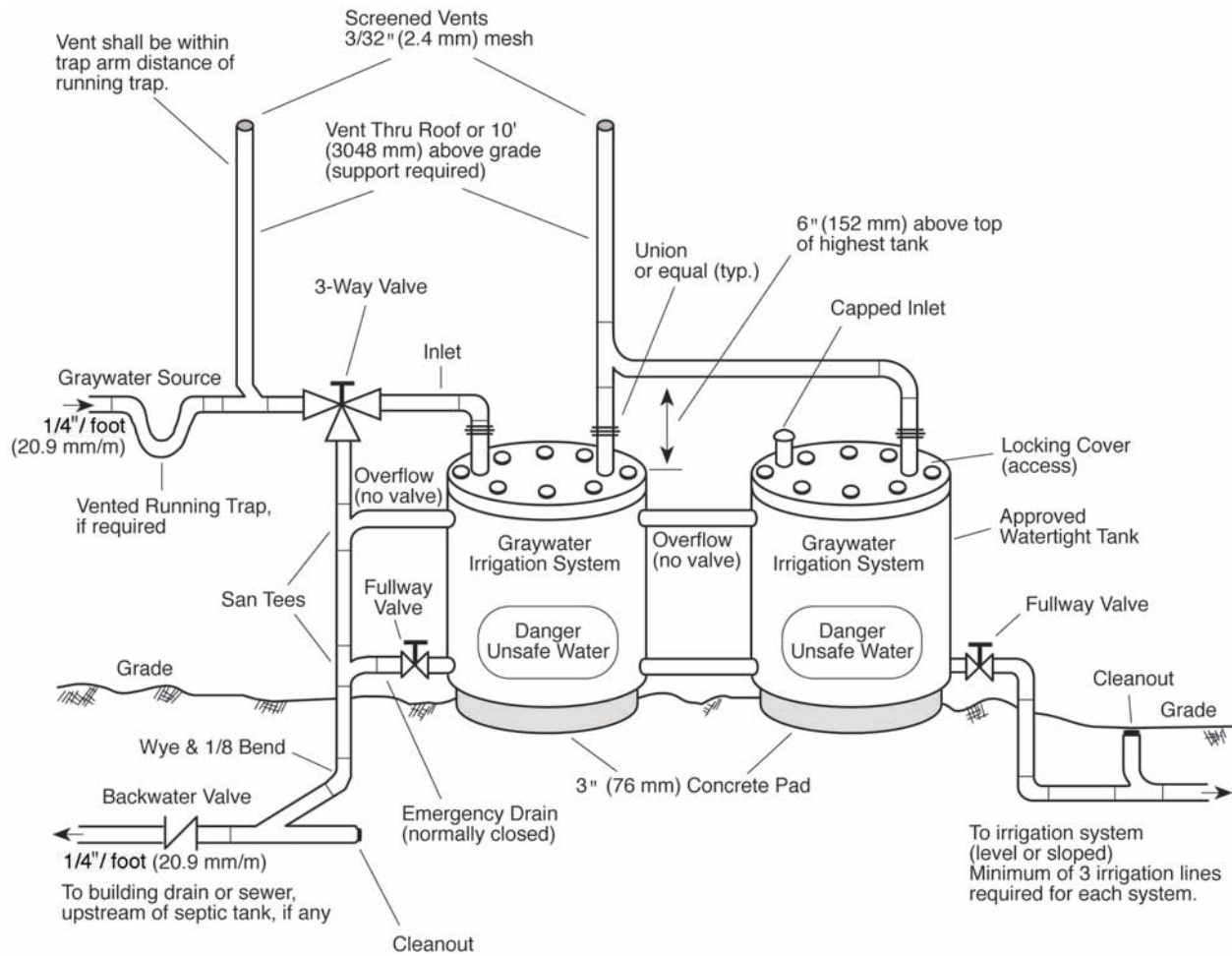


**Figure G-1**  
 Graywater System Tank – Gravity (conceptual)

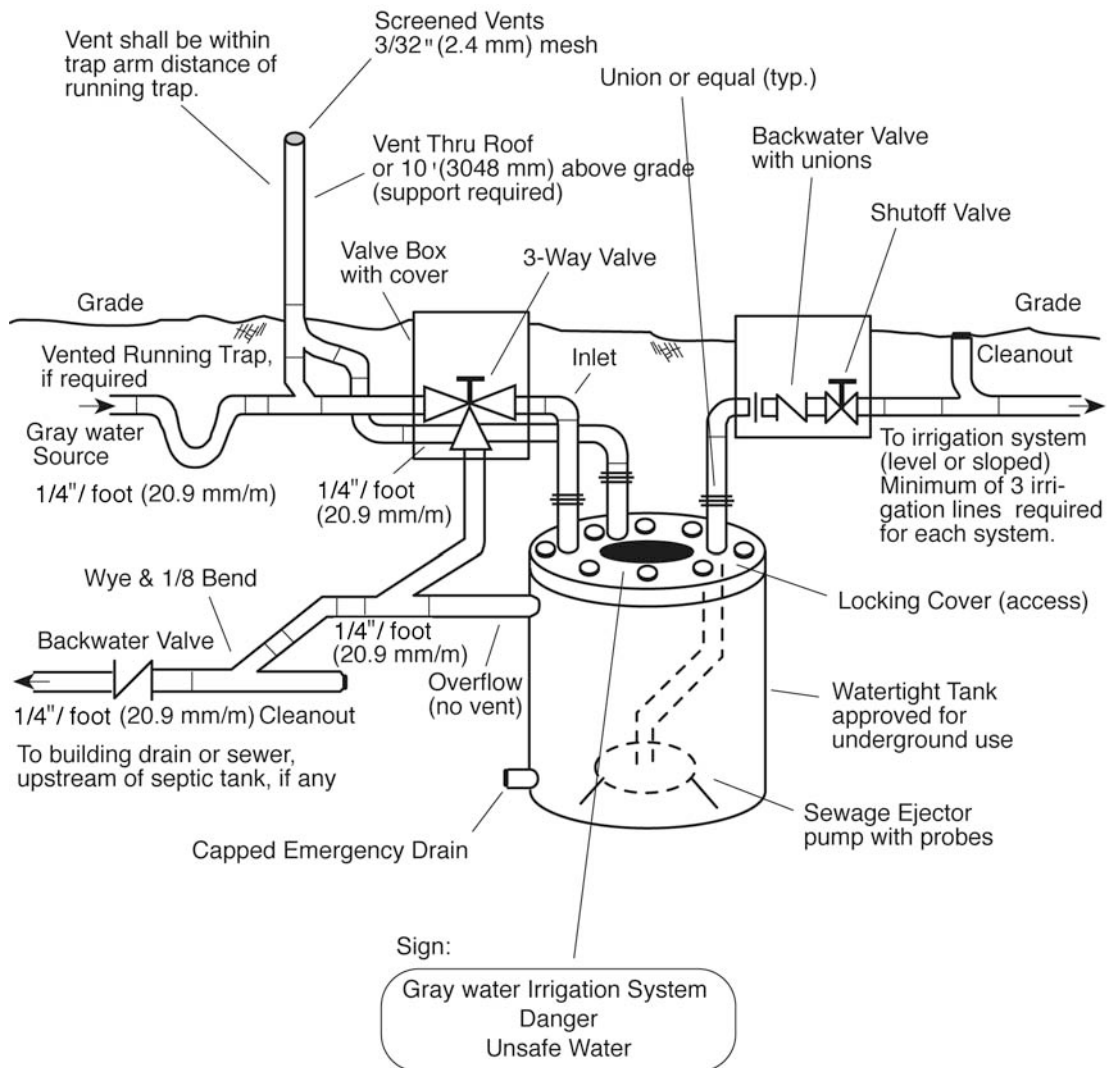


**Figure G-2**  
 Graywater System Tank – Pumped (conceptual)

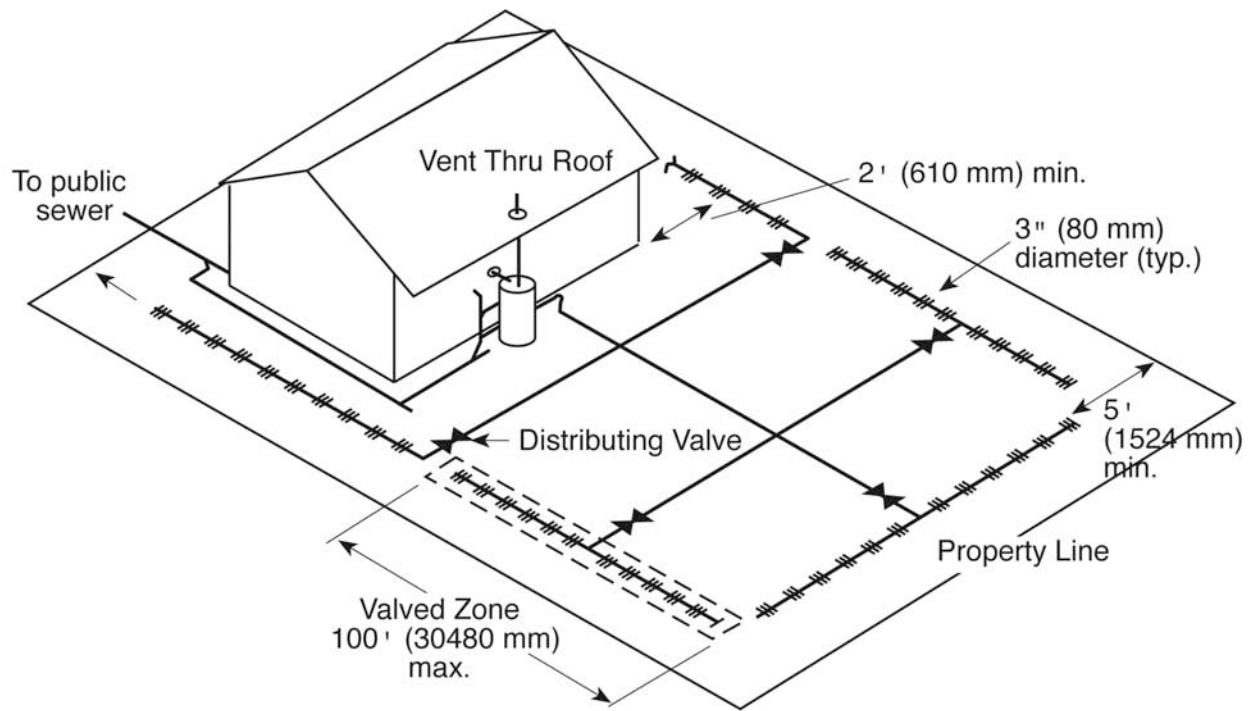




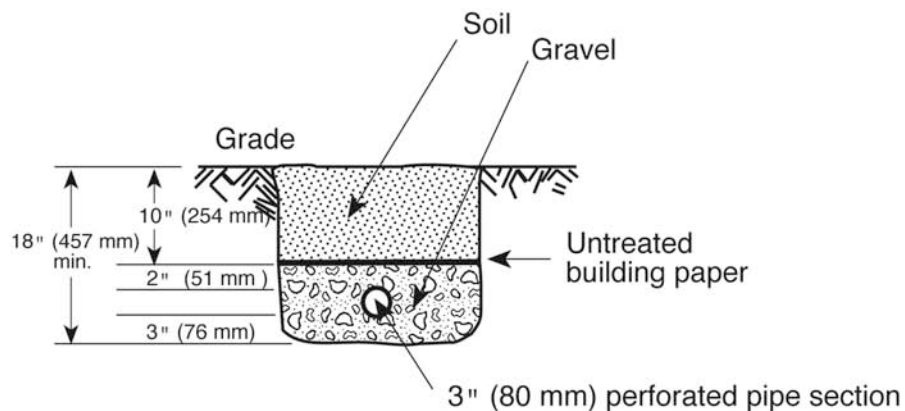
**Figure G-3**  
 Graywater System Multiple Tank Installation (conceptual)



**Figure G-4**  
 Graywater System Underground Tank – Pumped (conceptual)



Note: Each valved zone shall have a minimum effective absorption/irrigation area in square feet predicated on the estimated graywater discharge in gallons per day and on the type of soil found in the area. The area of the field shall be equal to the aggregate length of perforated pipe sections within the valved zone times the width of the proposed field.



**Figure G-5**  
Graywater System Typical Irrigation Layout (conceptual)





- ADOPTED: 1976**  
**REVISED: 1981, 1987, 2003**
- Step 1 Cut pipe square with hand saw and miter box, mechanical cut-off saw, or tube cutter designed for plastic.
  - Step 2 Ream inside and chamfer outside of pipe (to eliminate all burrs).
  - Step 3 Clean all dirt, moisture, and grease from pipe and socket. Use a clean, dry rag.
  - Step 4 Check dry fit of pipe in fitting. Pipe should enter fitting socket from 1/3 to 3/4 depth of socket.
  - Step 5 Apply a light coat of ABS solvent cement to inside of socket using straight outward strokes (to keep excess solvent out of socket). This is also to prevent solvent cement damage to pipe. For loose fits, apply a second coat of solvent cement. Time is important at this stage. See Section 2.7.3.4.
  - Step 6 While both the inside socket surface and the outside surface of the pipe are SOFT and WET with solvent cement, forcefully bottom the pipe in the socket, giving the pipe a one-quarter turn, if possible. The pipe must go to the bottom of the socket.
  - Step 7 Hold the joint together until tight (partial set).
  - Step 8 Wipe excess cement from the pipe. A properly made joint will normally show a bead around its entire perimeter. Any gaps may indicate insufficient cement or the use of light bodied cement on larger diameters where heavy bodied cement should have been used.
  - Step 9 The system shall not be tested until the joints have cured (set) at least as long as recommended by the manufacturer.

## **2.7.5 Special Joints**

### **2.7.5.1 Connection to Non-Plastic Pipe**

When connecting plastic pipe to other types piping, use only approved types of fittings and adapters, designed for the specific transition intended.



## HISTORY NOTE APPENDIX

### **California Plumbing Code (Title 24, Part 5, California Code of Regulations)**

*For prior history, see the History Note Appendix to the California Plumbing Code, 2001 Triennial Edition effective November 1, 2002.*

1. (BSC 05/06, DSA-AC 06/06, DSA-SS 06/06, HCD 03/06, OSHPD 07/06, SFM 03/06) Adoption by reference of the 2006 Uniform Plumbing Code (UPC) with necessary state amendments and repeal of the 2000 edition of the UPC. Filed with the Secretary of State on February 15, 2007 and effective on January 1, 2008.

2. Erratum to correct editorial errors in Matrix Adoption Tables, Chapter 4, Table 4-3, Chapter 6, Section 613, 614. Add missing Appendix Chapter G [DWR] Graywater Systems.